VOLUME XVIII Medical Lib. DECEMBER, 1927 JAN 18 1928 NUMBER 6

[FOUNDED IN 1906 AS THE AMERICAN QUARTERLY OF ROENTGENOLOGY]

THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

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PUBLISHED MONTHLY FOR THE AMERICAN ROENTGEN RAY SOCIETY
BY PAUL B. HOEBER, INC., 76 FIFTH AVENUE, NEW YORK CITY

AMERICAN ROENTGEN RAY SOCIETY
Twenty-Ninth Annual Meeting · Kansas City, Mo. · 1928
DATE TO BE ANNOUNCED

AMERICAN RADIUM SOCIETY
Thirteenth Annual Meeting—TO BE ANNOUNCED

SECOND INTERNATIONAL CONGRESS *of* RADIOLOGY
Stockholm, Sweden · July 23-27, 1928

Entered as second-class matter, March 3, 1916, at the Post Office, New York, N. Y., under the Act of March 3, 1879.

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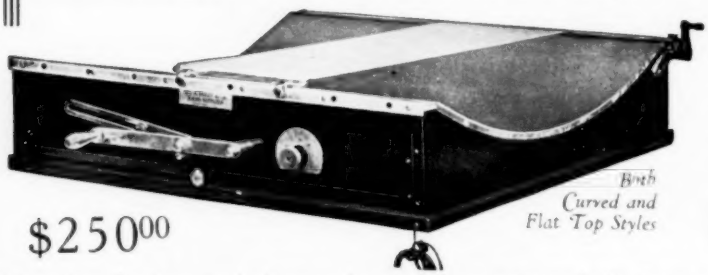

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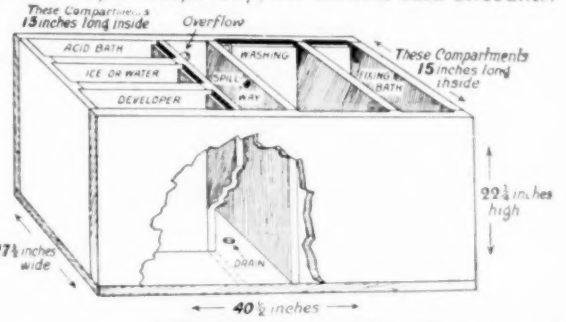

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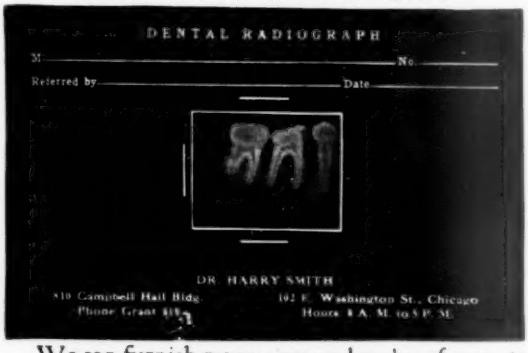

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THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

VOL. XVIII DECEMBER, 1927 No. 6

MALIGNANT TUMORS OF THE THYROID GLAND TREATED BY OPERATION, RADIUM AND ROENTGEN RAYS*

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I AM presenting this study of cases of malignant tumor of the thyroid gland for the purpose of (1) reviewing the case histories for clinical data, (2) carefully investigating the irradiation technique employed, (3) ascertaining the results so far obtained, and (4) correlating observations, improving, if possible, the classification and technique.

The surgical management in the past of patients with malignant tumors of the thyroid gland has been most discouraging. Craver asserts that the experience of Balfour and others indicates that there is no hope of cure from surgical measures when the growth has progressed so that a clinical diagnosis can be made. The treatment of the inoperable group with radium and roentgen rays has demonstrated clearly the possibilities of influencing the disease favorably.

The assumption is warranted that the treatment of malignant disease in general will yield the best results if cases are carefully selected and if the patient, clinician, surgeon, pathologist and radiologist cooperate thoroughly.

Toland states that the incidence of malignant tumors of the thyroid gland is as high as 6.75 per cent. He reports Kocher's percentage of about 7.45 and Wilson's of 1.75 and concludes that the average incidence for this country is about 3 per cent.

Although the number of cases in this series is too small to permit the drawing of exact conclusions, the data have definite value. Review of the literature did not reveal the report of a similar study. The difficulties encountered in this study emphasize the truth of Pfahler and Widmann's statement that, "a statistical study of the therapeutic result in carcinoma is always difficult because of the variable factors involved and the great difficulty of classification."

From January 1, 1917, to December 31, 1925, operation was performed at the Mayo Clinic in 11,103 cases of supposedly benign adenoma of the thyroid gland, and malignancy was found in 172* (1.55 per cent). Forty-five of these cases† are not considered in this series because treatment was by surgery only, and 40 other cases are added in which irradiation only was carried out during this period. Thus there were 167 cases within this period in which treat-

* These include the cases met with between January 1, 1917 and January 1, 1921, previously reported by Wilson.

† These cases have been reported by Pemberton and Bueermann.

* Read at the Twelfth Annual Meeting, AMERICAN RADIUM SOCIETY, Washington, D. C., May 16–17, 1927.

ment was carried out by irradiation alone or by surgery and irradiation.

Age and Sex. Three patients were in the second decade of life, 13 in the third, 26 in the fourth, 41 in the fifth, 49 in the sixth, 33 in the seventh, and 2 in the eighth. Thus: 25.14 per cent were of precancerous age, 24.55 per cent were of "cancer age" and 50.30 per cent were of postcancerous age. The youngest patient was fifteen and the oldest was seventy-five. More than half (115) of the patients were females.

In 84 cases the tumor enlarged gradually. Recent enlargement (within five years) was recorded in 49 cases, and rapid enlargement (within a few months) in 28, and in 6 cases the duration was not recorded on the history. The average duration was approximately 9.85 years, indicating that the tumors were of a fairly low-grade malignancy.

Classification According to Operability. As yet the limitations of the surgeon and radiotherapist are not clear cut; this adds greatly to the difficulty of a proper classification of cases. The size of the primary tumor, the presence of local and distant metastasis, and the degree of destruction of vital structures by the carcinomatous process, as well as the grade of the malignancy and general condition of the patient should be taken into account.

In a measure, operability was not dependent on the size of the tumor since the largest tumor noted in the operative group was 17 by 9 cm., while the largest tumor in the inoperable group was 18 by 20 cm. However, the size and situation of the primary tumor usually determines the operability.

From the standpoint of the radiotherapist the cases should be classified as: (1) operable, (2) borderline, (3) inoperable, and (4) recurrent. In this series, if the carcinoma was confined to one adenoma or was reported as completely removed surgically, the case was classified as operable. The borderline case was determined by the data furnished in the surgical notes. All cases in which suspicious areas remained and attachments were recorded were classified as borderline. The inoperable group was determined usually from the clinical opinion, but many lesions were found inoperable at exploration. The recurrent group represents cases recurring following surgical intervention. There were 58 cases in the operable group, 27 in the borderline, 70 in the inoperable, and 12 in the recurrent.

For purposes of convenience the operable and borderline cases, together with 6 of the recurrent cases, were grouped as "operative," and the inoperable cases, together with 6 of the recurrent cases, were grouped as "nonoperative." Thus, of the 167 patients 91 were treated by operation and irradiation, and 76 received irradiation alone.

From the operative data alone it is impossible to present the extent of local injury and the marked break in general health. In 48 cases the tumors had perforated the capsule of the gland; encapsulated tumors occurred in 43 cases; the surgeon definitely reported malignant tissue remaining in 29 cases; tumor attached to the trachea in 3 cases, and the tumor attached to the larynx in 1 case. The initial as well as the subsequent treatments are outlined in accordance with the completeness of the surgical procedure. It seems paramount that the surgeon should carry his operative procedure as far as can be done safely; he should not assume any unnecessary risk.

Metastasis. Local and distant metastasis adds much to an unfavorable prognosis, but it aids in deciding on measures to be initiated in combatting the disease. In the operative group cervical lymphatic enlargements were recorded in 16.48 per cent, and in 7.69 per cent distant metastasis was noted. In the nonoperative group local lymphatic enlargements were noted in 59.21 per cent, and in 52.63 per cent metastasis to distant structures. In many cases it is as yet impossible to determine definitely whether or not metastasis has occurred. If the local infiltration invaded the trachea or esophagus, palliation was very limited. However, if the primary lesion was operable, metastasis to rather unimportant structures did not make the case inoperable, and marked palliation occurred following operation and irradiation.

Diagnosis. Early malignancy of adeno-

matous goiter cannot be diagnosed clinically; nevertheless, if proper measures are instituted immediately the diagnosis is made, the ultimate outlook should be very good. Malignancy was demonstrated pathologically in 97.80 per cent in the operative group and in 98.04 per cent in the nonoperative group. This high percentage shows with what accuracy a pathologic diagnosis can be made. In many cases only a small portion of the primary or metastatic tumor was examined; possibly a more representative section of the primary tumor would have resulted in even a higher percentage. The low figure is not representative of the consultant's diagnostic ability in the operative group (Table I). We appreciate the limitations in this group and yet it is certain that the diagnosis of malignancy was made in a greater number of the cases, however, not especially recorded as such. Further, the operation was indicated and the specimen was carefully examined for malignancy.

TABLE I
DIAGNOSIS OF MALIGNANCY

	Operative Group		Nonoperative Group	
	Cases	Per Cent	Cases	Per Cent
Clinician	29	31.87	74	97.37
Surgeon	45	49.45	46	90.19
Pathologist	89	97.80	50*	98.04

*51 cases in nonoperative group had specimens removed for diagnosis.

Type of Malignancy. Carcinoma occurring primarily in the thyroid gland was found in 89 cases in the operative group and in 73 cases in the nonoperative group. A sarcomatous process was recorded in 1 case in the operative group and in 3 cases in the nonoperative group. Carcinoma in an aberrant thyroid was noted in 1 case in the operative group.

In all but 10 cases in the operative group, the grade of malignancy was recorded. The data furnished here conform to the malignant status of the disease clinically. They also clearly indicate the necessity of early surgical removal of tumors of the thyroid gland. In the operative group, 71.41 per cent were graded 1 and 2. Only 48.69 per cent of the nonoperative group were graded, however. It seems significant that about half of the graded tumors were graded 3 and 4. These types enlarge more rapidly and disseminate more readily, thus greatly reducing the chance of surgical removal of the tumors. It seems essential for good and lasting results to remove all tumors of the thyroid gland early and then by a careful pathologic analysis of the tissue, decide on a definite irradiation program and follow-up system, rather than to proceed with ordinary methods until the disease is beyond the confines of its original site.

The cases were grouped according to the year of the initial operation or treatment. For the last five years the percentages varied little; the lowest was 12.57 per cent and the highest was 17.96 per cent. The figures for the first four years furnish material for speculation. It seems rather conclusive that the cases of carcinoma do not pass unrecognized. All concerned must be on guard in order not to overlook a carcinomatous process in an adenomatous goiter (Table II).

TABLE II
GROUPING ACCORDING TO YEARS

	Operative Group		Nonoperative Group		Total	
	Cases	Per Cent	Cases	Per Cent	Cases	Per Cent
1917	2	2.20	2	2.63	4	2.39
1918	10	10.99	7	9.21	17	10.18
1919	7	7.69	6	7.89	13	7.78
1920	6	6.59	7	9.21	13	7.78
1921	12	13.19	9	11.84	21	12.57
1922	14	15.38	15	19.74	29	17.36
1923	7	7.69	9	11.84	16	14.37
1924	17	18.68	13	17.11	30	17.96
1925	16	17.58	8	10.52	24	14.37
Total	91		76		167	

TREATMENT BY IRRADIATION

It is not within the scope of this study to demonstrate the importance of individualizing procedures to combat neoplastic disease of the thyroid gland; therefore no attempt is made to show the results in terms of different surgical and irradiation techniques. An attempt will be made, however, to present an idea of the range of radium and roentgen-ray treat-

ment employed. It is necessary to formulate a rather definite radiotherapeutic program based on the available data for the individual case. Among the most important are clinical and surgical opinion, grade of malignancy, and extent of local and distant destruction or impairment of function of important structures which usually determines the status of the patient.

The radium treatments may be classified under the following headings:

1. All cases receiving full treatment were classified under the heading "complete."

2. At times it is considered inadvisable to complete the treatments and yet the factors already employed are known to be of definite value in the management of similar cases treated in the past: such cases are classified as "limited."

3. Cases in which the surgeon has removed all the apparent diseased tissue, or the pathologist reports the malignant process as encapsulated or within an adenoma, are classified under "prophylactic." In a few such cases it was noted that some indefinite infiltration was found in the operative or treatment field following an interval of a few months, usually at the time of the check-up examination.

4. In the fourth, the pre-operative group, are few cases since preparation for surgical procedures is as yet seldom employed. However, this type of treatment may be employed more freely in the future.

5. In the fifth group are cases in which it is necessary to abandon treatment on account of several possible untoward complications.

It was possible to give complete treatment in 74 cases in the operative group and 68 cases in the nonoperative group. Limited treatment was given in 15 cases in the operative group and in 7 cases in the nonoperative group. Prophylactic treatment was given in 1 case, and preoperative treatment in 1, both of the operative group. In only 1 case, in the nonoperative group, was the treatment abandoned, indicating the safety of the treatment-factors employed.

Radium Technique. In the operative group complete treatment usually consisted of radium application through a drainage tube placed at operation, and surface radium packs to the operative or thyroid area as soon as the wound was healed. Forty-two cases in which drainage tube treatments were employed were analyzed. The shortest interval between operation and treatment was when the surgeon placed both tube and radium at the time the wound was open, and the longest interval was eleven days. The average interval was about three days. The strength of the radon tubes varied from 42 to 64 millicuries. The average of forty-five applications was 50.75 millicuries. The filtration was as follows: The brass wall of the applicator was 0.75 mm. thick, and the wall of the drainage tube usually from 1.0 to 1.5 mm. The treatment time varied, the shortest application being six hours and the longest sixteen hours; the average time was about thirteen hours. The average millicurie-hours for one area was 639.

There were 60 cases in which the surface radium pack was analyzed. Treatment was usually given as soon as the stitches were out and the wound healed. The universal silver tube applicator, walls 0.5 mm. thick, containing 50 mg. of radium sulphate (element) or radon, in a similar tube of brass, walls 0.75 mm. thick, of corresponding strength, was employed. The average strength was 54.41 mg. or mc. Added filtration of 2.0 mm. of lead and 2.0 mm. of Para rubber was used. The distance was maintained by the interposition of a Balsa wood block 2.5 cm. thick and about 3.5 cm. square at its base. The treatment field was mapped out in areas measuring about 4.0 cm. square. The number of areas depended on the extent of the involvement. The average number of hours for one treatment area was about sixteen. The average number of total milligram-hours to a treatment field was 7123.20 and the average total number of areas treated was eight, two or three areas treated at a time.

The limited, prophylactic, pre-operative, and abandoned treatments were modifications of the foregoing to meet the needs of the individual case. However, the number of applications was reduced.

Steel alloy needles containing 5 and 10 mg. of radium sulphate (element) were

employed in 8 cases. In this small number, it was anticipated that the primary tumor was inoperable so with this in mind the needles were prepared for use. The tumors were exposed in the usual manner for thyroidectomy, and the needles were buried in the substance of the tumor about 2 or 3 cm. apart. From five to ten needles were placed in a single treatment. The treatment time varied from twelve to twenty-four hours. The average was 17¾ hours; the average total milligram-hours numbered 1425.

In the nonoperative group the surface treatment was the most common one outlined. Owing to the greatly enlarged tumors, a larger number of areas was necessary and the total number of milligram-hours was greater than in the treatment of the operable group. The factors were the same. The average number of areas was sixteen and the average number of milligram-hours was 13,524. To arrive at these figures 48 cases were analyzed. In 1 case only four areas were treated; in another forty-two areas were treated.

In all there were 68 cases in which radium treatment alone was given. Radium applications were recommended if the lesion was limited to the operative field, and if there was a possibility of distant involvement roentgen rays were applied to these areas. This accounts for the large number of cases (50) in the non-operative group receiving radium to the area of the thyroid gland and roentgen rays to the metastatic areas (Table III).

TABLE III

HISTORY OF GOITER

	Cases	Per Cent
Gradual enlargement	84	50.30
Recent enlargement (within 5 years)	49	29.34
Rapid enlargement (in terms of months)	28	16.76
Not recorded	6	3.60

Shortest duration, 3½ weeks (male, married, aged 62)

Longest duration, 42 years (female, married, aged 61)

Average duration, 9.85 years

Roentgen-ray Technique. The technique in roentgen-ray treatment has varied greatly. In the cases treated in 1919, and for a few years afterward, the factors in vogue at that time were used, for example, sphere gap 9 inches, distance 9 inches, milliamperes 5; filtration 3.0 mm. aluminum, time six minutes. The fields were multiple and small, usually over the regional metastatic areas.

In 1922, records show that the technique was as follows: kilovolts 135, distance 40 cm., milliamperes 5; filtration 6 mm. aluminum, 0.5 mm. copper, time thirty-five to sixty minutes. The fields were fewer in number and larger in size. With the advent of high voltage technique, it was employed in combination with the low voltage; that is, to one or two posterior fields, the dose being delivered to the mediastinal glands. The following factors are recorded: kilovolts 200, distance 50 cm., milliamperes 5; filtration, copper 0.75 mm., and aluminum 2.0 mm., time one hour and thirty minutes divided into two periods.

Subsequent Treatment. The number of subsequent radium treatments varied. In the operative group there was little need for subsequent treatment and in the non-operative group the initial treatment was considered a therapeutic test and if the result was not satisfactory further treatment was not recommended. The interval between the first and second radium treat-

TABLE IV

SUBSEQUENT RADIUM TREATMENT

	Operative Group, Cases	Non-operative Group, Cases
One subsequent treatment	4	15
Two subsequent treatments	6	8
Three or more subsequent treatments	5	13
Subsequent treatment elsewhere	4	3
Total	19	39
Largest number of subsequent treatments recorded for one case	12	10

SUBSEQUENT ROENTGENOTHERAPY

One subsequent treatment	4	11
Two subsequent treatments	4	–
Three or more subsequent treatments	6	4
Subsequent treatment elsewhere	9	–
Total	23	29
Largest number of subsequent treatments recorded for one case	–	12

ments was usually of two or three months, and later the intervals were lengthened to six, nine and twelve months; some patients have not received treatments for several years. Eighteen subsequent roentgen-ray treatments were analyzed. The average interval was three months. No attempt was made to determine the number of cases in which one initial radium treatment was given and one or more subsequent roentgen-ray treatments. It was observed that this combination was employed in several cases, since in many instances the radium was not available in the patient's locality (Table IV).

Results. The results can be examined under two headings: the initial or immediate, and the late. It was not considered of value to separate the cases into groups according to the methods employed in their management. Each case was treated individually. The surgical risk was taken into account and every endeavor on the part of the surgeon and radiologist was made not to increase this risk. It is possible that mild treatment erythemas occurred of which no record was made. In the operative group, only one instance of first degree erythema was noted. In the same group, 5 cases of myxedema are recorded which were easily controlled with thyroxin. Wound infection was noted in 4 cases in which drainage tube applications were employed. Evidently this is a low incidence of wound infection. In 2 cases, postoperative or post-treatment thyroiditis was sufficient to cause myxedema. Myxedema did not occur if there was no wound infection. In the nonoperative group of cases 6 were recorded in which mild erythema occurred; in 3 healing was prompt. One case required repeated treatments; telangiectasis and treatment fibrosis occurred, the latter limiting the movement of the head. The patient is now well and has not received treatment for several years. In one case, the patient applied an ice bag to the treatment field which intensified the reaction; however, healing soon occurred, leaving a minimal scar. Mild telangiectasis is reported in one case.

Of the 91 patients in the operative group, 56 are apparently cured. Nine are definitely improved; their condition was in the borderline of operability. Of the 76 patients in the nonoperative group, 58 are dead. Palliation was all that could be hoped for and this occurred in varying degrees. Forty patients were improved. Six did not improve and death occurred within a short time.

As yet there is no satisfactory method of selecting patients for treatment. The risk of treatment is practically nil, so when it is estimated that the patient will live even six or eight weeks (since it requires this length of time for benefit to occur) irradiation should be instituted and in some a decompression operation is indicated. The initial treatment may be considered a therapeutic test and if effective following an interval of two or three months further treatments are indicated.

Mortality. Of the 22 deaths in the operative group, 18 are known to be due to carcinoma. In one case tuberculosis was given as the cause, but active carcinoma may have been present; however, necropsy was not performed. Wound infection was considered a contributory factor in one case and may have played the principal rôle in the cause of death. In one case death followed postoperative pneumonia after herniotomy and the case was pronounced clinically free from active carcinoma. No hospital mortality occurred in this group.

Of the 58 deaths in the nonoperative group, all were classified as due to carcinoma except one which should be considered as possibly due to treatment. There was diffuse bilateral enlargement of the thyroid gland of short duration. Exploration revealed a highly malignant inoperable tumor. Radium needles were placed throughout the tumor in areas varying from 2 to 3 cm. in diameter. The tumor was very vascular. The course following treatment was stormy with rapid diminution in the size of the tumor. The latter may be attributed to the therapeutic rays as well as to secondary wound infection. The infection and necrosis was the cause of the serious complications and should be considered the contributory cause of death. This case was the only one of its kind in the series and should another present itself radium surface pack treat-

TABLE V

MALIGNANCY OF THYROID

SURGICAL TREATMENT AND TREATMENT BY IRRADIATION

1917 to 1925 Inclusive

End Results

Cases in Group, 91; Patients Heard from, 87 (95.6 Per Cent)

	Grade 1, Cases	Grade 2, Cases	Grade 3, Cases	Grade 4, Cases	Grade not Recorded, Cases	Total	
						Cases	Per Cent
Lived less than 1 year	0	3	1	3	0	7	8.04
Lived 1 year and more	27	33	7	4	9	80	91.95
Lived 2 years and more	24	28	6	3	6	67	77.01
Lived 3 years and more	16	23	4	2	6	51	58.62
Lived 4 years and more	14	17	1	1	3	36	41.37
Lived 5 years and more	12	12	0	1	2	27	31.03
Lived 6 years and more	6	10	0	1	1	18	20.68
Lived 7 years and more	4	6	0	0	1	11	12.64
Lived 8 years and more	0	4	0	0	1	5	5.74
Lived 9 years and more	0	1	0	0	0	1	1.14
Average postoperative life, months..	50.55	49.27	30.87	24.14	43.66	45.38	

TABLE VI

TREATMENT BY IRRADIATION

1917 to 1925 Inclusive

End Results

Cases in Group, 76; Patients Heard from, 71 (93.42 Per Cent)

	Grade 1, Cases	Grade 2, Cases	Grade 3, Cases	Grade 4, Cases	Grade not Recorded, Cases	Total	
						Cases	Per Cent
Lived less than 1 year	1	3	1	9	23	37	52.11
Lived 1 year and more	9	7	2	3	13	34	47.88
Lived 2 years and more	8	6	1	1	6	22	30.98
Lived 3 years and more	4	4	1	0	5	14	19.71
Lived 4 years and more	3	2	1	0	4	10	14.08
Lived 5 years and more	1	2	1	0	4	8	11.26
Lived 6 years and more	0	2	1	0	4	7	9.86
Lived 7 years and more	0	0	0	0	2	2	2.81
Average posttreatment life, months..	34.20	32.50	31.33	8.08	17.88	21.24	

ment would be recommended rather than the buried radium needles.

The cases in the operative group are listed in Table v according to the grade of malignancy. The best results were obtained in cases graded 1. The average postoperative life was four years and two and a half months. The average postoperative life in cases graded 4 was slightly more than two years. Surgeons appreciate the significance of this gradation and their procedures are governed accordingly. Evidence clearly indicates that the best method to employ in treating neoplastic disease of the thyroid gland is the complete removal of all diseased tissue when possible with safety, followed by radium and roentgen-ray treatment. As the grade of malignancy increased, the length of postoperative life decreased, substantiating Broders' observations on malignant processes in other tissues.

In many of the cases of the inoperable group (Table vi) treated in the early years of this study there was no biopsy to complete the pathologic data. The apparently hopeless status of many of the patients which argued for the least possible surgical intervention accounts for the lack of biopsy material. The cases in which the grade of malignancy was recorded show agreement with Table v; as the grade of malignancy increases the number of postoperative months decreases. Owing to the apparent hopelessness of the cases in this group, it is unfair to compare them with the cases noted in Table v. However, the data clearly indicate the possible good that may

be expected from adequate treatment. Fourteen of the patients are alive after three years and 8 are alive after five years. In some the dyspnea and dysphagia were so great before treatment that it would seem reasonable to conclude that the length of life could be estimated in terms of days rather than years. About 10 per cent of the patients have lived longer than six years and they are free from apparent active disease and have not received treatment for many years.

SUMMARY

In the application of radium (salt) or radon through drainage tubes, the strength should be about 50 mg. or mc. The filtration should be at least equal to 0.5 mm. of silver and, when possible, 1.0 mm. of brass should be used. The wall of the rubber drainage tube should be at least 1.0 or 2.0 mm. thick. The time of application varies and is dependent on the presence or absence of important structures in the treatment field (blood vessels, nerves, and so forth); further, if the applicator is just beneath the skin the time should be reduced at least one-third or one-half of the average time. When surgery is contraindicated, especially in the nodular fixed tumor, radium needles (salt) should be buried through the mass; the average dose mentioned here seems safe. If the tumor is a diffuse, medullary type, radium surface packs or roentgen-ray treatment should be chosen. Surgical interference in this type should be limited to removal of a specimen for study. The factors for radium surface treatment seem safe; however, since erythemas have occurred, the time factor should be reduced to ten or twelve hours. In a general way, the surgeon should carry his procedure as far as safety will permit, the radiologist giving full co-operation at the time of operation and during the postoperative course. If radium is not available, roentgen-ray therapy is indicated as a postoperative measure.

This brief study emphasizes that malignant goiters should be excised if possible and decompression performed when necessary followed by irradiation. The removal of adenomas of the thyroid in selected cases seems to be a satisfactory prophylactic procedure in the prevention of malignant disease. All cases should be classified according to operability. They should be further classified as to whether or not the irradiation was complete or incomplete. A careful follow-up plan should be instituted in order that activity may be determined as early as possible.*

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* For discussion of this paper see page 512.

CLINICAL EVIDENCE OF THYROTOXIC CONTROL AFTER RADIUM THERAPY*

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THIS paper is an attempt to answer the question whether the radium treatment of patients with thyrotoxicosis is supported by the results achieved as judged by the clinical course of cases so treated and the persistence of the beneficial effects.

The arguments favoring radium therapy are simplicity of treatment, avoidance of shock and apprehension about an operation, hospitalization for only one day resulting in lessened initial cost, the continuation of income production since the milder cases resume their occupation on the second day, the possibility of treating inoperable and postoperative cases, and the avoidance of operative mortality.

From a study of the many cases treated by radium there is evidence of some involution in the histopathological structure of the gland which often parallels the clinical course, yet the anatomical picture does not always follow the clinical results. Many cases show marked improvement in subjective and objective symptoms in a few weeks, yet it is eight to ten months before there is marked decrease in the size of the gland. Again, if treatment is given during a remission when the activity of the toxic gland is at its lowest ebb, the results are noted earlier and decrease in size may precede the disappearance of the toxic symptoms.

In the toxic adenoma cases of long standing, with several crises and remissions in the past, the results of treatment are much slower, because some immunizing force seems to hold a balance, so that the symptoms subside only after the gland commences to decrease in size. Again, a case with activation at the peak of a crisis, that has been given iodine, will have a stormy convalescence, and may develop sequelae that are alarming.

Discretion in radium treatment, the same as in surgery, must be used in cases with acute attacks of gastric disturbance, auricular fibrillation, acute mania, true psychosis, and those with very sudden loss of weight. Clinical findings must be depended upon and if necessary medical measures, such as rest, ice bag, etc. employed for six or eight weeks, until the progress and severity of the attack can be estimated before radium treatment is given.

The clinical findings must be checked up with blood sugar and urea estimations. Roentgen examination of the chest for mediastinal tumor or substernal thyroid, a differential blood count, a basal metabolic test and electrocardiographic examination should be made. All measured evidences of faulty metabolism, pathologic and physiological activity are important statistics for comparative study.

The symptoms of toxic thyroid are so many and varied in different individuals that it is difficult to state the sequence of their disappearance after treatment. Usually the tremor is the first symptom to subside after radium treatment. The improvement is gradual and is noticed in six weeks, and after four months tremor of hands or limbs is seldom seen.

Gradual loss of weight while in the toxic state is one of the outstanding observations. This phenomenon will continue for some weeks after the radiation treatment, but a gradual increase in weight after two months is the best assurance of control of the toxic condition. Many emaciated individuals gain from 5 to 50 pounds within a year, regain their former strength as their digestion improves, sleep well and apparently have a new lease on life.

Vasomotor disturbances such as sweating, loss of hair and trophic changes in nails, show gradual improvement after the toxicity is controlled.

Reduction in size of the thyroid gland is in direct relation to the amount of hyperplasia of the glandular tissue present. More time is required to reduce a cystic adenoma than a simple hyperplasia of the gland. Those glands enlarged from

* Read at the Twelfth Annual Meeting, AMERICAN RADIUM SOCIETY, Washington, D. C., May 16–17, 1927.

true hypertrophy and connective tissue formation, or those with calcareous degeneration, are considered surgical problems.

A guarded prognosis should be given with regard to exophthalmos, but from clinical observation it has been noted that cases of less than two years' duration improve, some to the extent of normal appearance.

The thyrotoxic individual with a high systolic and a low diastolic blood pressure shows improvement in these symptoms in two or three months. The systolic pressure recedes unless there is some grave cardiovascular condition present, while the low diastolic rises when compensation is being established.

The metabolic rate, being one of the measured evidences of thyroid activity, stands pre-eminent as a convincing factor when a second test, taken six months after the treatment, gives a normal metabolism. Cases with a very high metabolic rate and a pulse rate of 150 or over do not have a normal metabolism in six months but will show improvement; if normal in one year the results are gratifying.

Emaciation with pigmentation and at times edema of the extremities, with a failing heart are evidences of severe toxicity. Some months will intervene between the advent of increased body weight and the loss of pigmentation of the skin or the edema. If the pigmentation is due to the gastric and liver disturbances, it will clear when the thyroid gland becomes less active. The edema does not disappear until the thyrocardiac disturbance is controlled and compensation established.

Last but not least, the tachycardia, fibrillation and general cardiac disturbances respond slowly but do gradually improve. Digitalis, rest and the ice bag for a few weeks at first will aid to tide over an overworked heart until after the active stage of the treatment has passed. Comparative roentgen examinations of the chest before and three months after treatment demonstrate decrease in the cardiac shadow. Unless extensive myocardial degeneration has taken place good results may be prophesied in most cases up to forty-five years of age. An apex beat of 140 before treatment should be 100 six months after treatment and only slightly above normal in one year. When compensation is established the individual loses the feeling of fear or apprehension, becomes calm and confident, and when assured that the other symptoms are better, resolves into a feeling of "well being."

The extremely critical cases that the surgeon dreads can all have the benefit of radium treatment, provided the gastric disturbance is not so great that food cannot be retained.

A guarded prognosis should also be given in the cases of psychosis because there is no immediate improvement in thyrotoxic activity, and in the meantime life may be terminated by starvation or self-destruction. In this series of 400 cases treated there have been 6 with extreme toxic psychosis to the extent of mania. Four of the cases died within a few days, long before they could receive any benefit from the therapy. Twenty-two cases had had thyroidectomy, and 3 had had two operations done from two to four years prior to the last activity; and all of these have remained well since treatment with radium.

The polycystic adenoma cases that become active receive a second treatment after all toxic symptoms have subsided, following the first year, to reduce the deformity of the enlarged gland.

Twelve cases, to my knowledge, have had thyroidectomies after the toxicity had been controlled with radium to remove the enlarged adenoma. Three of these cases died suddenly within two days from embolism.

Only 4 cases of this series have had recurrences of former toxic symptoms, and all were treated over four years ago, when the technique was not what it is today. A second treatment was given in each case, with a ready response.

The following typical cases are reported to show the usual clinical course following radium therapy.

CASE REPORTS

CASE NO. 654. May 3, 1921. Male, aged fifty-three; occupation, tinner.

Complaint. Goiter, weakness with nervousness. Duration four years.

Family History. Negative, except that one sister had a goiter.

Personal History. Had diphtheria at ten years of age. Had several attacks of sore throat, which were precipitated by changes of the weather or exposure. Present illness began about four years ago following an attack of tonsillitis. He feels extremely nervous, perspires easily, has palpitation after eating or on the least exertion, and cannot work on account of fatigue.

Examination. Both eyes prominent, giving him an anxious expression, his skin is sallow and tongue tremulous. Both tonsils enlarged, red, injected and have the appearance of being chronically infected. The neck is decidedly enlarged over the thyroid gland. The upper circumference measures $15\frac{3}{4}$ inches, and the lower circumference $16\frac{3}{4}$ inches. The right lobe of the thyroid gland is larger than the left and many small cysts are palpable within the adenoma. Heart action rapid, giving a heavy apex impact, but no murmurs are detected. Pulse rate 100. Systolic blood pressure 180, diastolic 100; basal metabolic rate +27. The hands and fingers have a fine tremor on extension.

Diagnosis. Toxic adenoma with exophthalmos.

Prognosis. Good.

Treatment. One hundred eighty milligrams radium screened in 1 mm. of brass and rubber, with the tubes laid 1 cm. apart on a 2 cm. gauze pad, was held over the left lobe of thyroid gland for eight hours, and then over the right lobe for ten hours.

Sept. 30, 1921. Four and a half months since the treatment, and all of the above subjective and objective symptoms have subsided. He has been able to work for the past three months. The neck measurements are one inch smaller and except for the fullness of the eyes there is no noticeable evidence of the former activity. Pulse rate 82; systolic blood pressure 150, diastolic 90, giving a decrease of 20 in the pulse pressure; basal metabolic rate +1.9.

The patient has reported several times within the past six years that he has been entirely free from symptoms and able to continue his work as a contracting tinner.

Case No. 687. July 27, 1921. Male, aged thirty-six. Occupation, farmer.

Complaint. Loss of weight, general weakness, and fullness of eyes.

Duration. Six months.

Family History. Negative.

Past History. Had typhoid fever three times, and asthma until he was fourteen years of age, and tonsillitis repeatedly.

Present History. Five months ago he had the grippe and has been gradually getting weak, lost 45 pounds in weight, and perspires freely. Complains about severe pains above the eyes and has been unable to work. Two months ago had both superior thyroid arteries ligated, with very little relief.

Examination. Eyes staring with an anxious, wild expression; sclera showing beneath each cornea. Skin of face and shoulders covered with an acne, no doubt due to bromides. Tongue tremulous, teeth fair, both tonsils enlarged, ragged, with an infected appearance. Neck full over thyroid gland, showing two scars where the superior thyroid arteries were ligated. Both lobes of the thyroid gland are larger at the clavicular angle and are connected with a wide firm isthmus. Chest thin with atrophy of intercostal muscles, the left thorax pulsates with each apex beat. A rubbing or friction sound is heard at the apex of heart, which lies directly beneath the left nipple, and a systolic murmur is elicited. Apex beat and radial pulse registered 128. The systolic blood pressure is 160, diastolic 80; basal metabolic rate +39.7; weight 115 pounds. His arms are emaciated; tremor of fingers and hands on extension, the nails showing longitudinal striation.

Diagnosis. Exophthalmic goiter.

Prognosis. Good. Should control the toxic symptoms.

Treatment. One hundred milligrams of radium in tubes, screened with 1 mm. of brass and rubber. The tubes were placed 1 cm. apart on a gauze pad 2 cm. thick, and held over each lobe of thyroid for ten hours.

(Each tonsil was treated with 30 mg. of radium for ten hours, at the same time.)

Sept. 20, 1921. In two months' time he claims that he feels stronger, sleeps better, and has a good appetite. There is no improvement in the heart action or in size of the neck, yet the thyrotoxic condition must be better because his basal metabolism is only +13, and he has gained 19 pounds in weight.

June 12, 1922. After eleven months he returned for observation and reports that he resumed work three months after the treatment, that he has been feeling very well, and that he reached 140 pounds in weight, but that he lost 12 pounds in the last few months, due to his exercise in putting in the spring seeding.

Examination. His color is much better. Eyes less prominent. Neck one inch smaller in the lower circumference measurement. Apex beat 80; no heart murmurs, and only a slight tremor of fingers is perceptible. Weight 128 pounds. Systolic blood pressure 140, diastolic 80; basal metabolic rate +11.5.

May 1, 1927. Reports by letter that his weight is 200 lb. at present.

CASE NO. 977. May 25, 1924. Female, aged thirty-three. Married, housewife.

Complaint. Nervousness with trembling of limbs; fatigue.

Duration. One year.

Family History. Negative.

Marital History. Married when twenty-six years of age. Had two children, now three and six years of age, and one miscarriage. The first delivery instrumental, the second normal.

Personal History. For the past year she has been getting more nervous, with occasional headaches and a feeling of lightness of the head. Limbs and hands tremble, and she is always fatigued. Digestion poor, so that she has distress after eating, is fearful, discouraged, and has a constant pressure over her thyroid gland.

Examination. Eyes and mouth negative. Neck enlarged over the thyroid gland. Both lobes of the gland enlarged and connected by a circular band a quarter of an inch wide, forming an isthmus that firmly compresses the trachea, causing a choking sensation. After twenty-four hours' rest the heart action was regular, giving an apex beat of 84, but on exertion recorded 120. Systolic blood pressure 120, diastolic, 84; basal metabolic rate, +14.4; weight, 114 pounds. There is a very distinct tremor of the hands and fingers, with a rhythmic shaking of the knees.

Diagnosis. Toxic adenoma.

Treatment. Ninety milligrams of radium in tubes, screened with 1 mm. brass and rubber, laid 1 cm. apart on 2 cm. of gauze and held over each lobe of the thyroid, overlapping the isthmus, for ten hours.

Nov. 28, 1924. Had no trouble with choking for two months, and none of her former complaints except palpitation of the heart on exertion. Recently had a bronchial infection and noticed that coughing increased the heart action perceptibly.

Examination. Neck much smaller in size. Cannot feel either lobe of thyroid, and only a remnant of the circular cystic isthmus remains, but does not cause pressure or choking now. Radial pulse and apex beat, 80; weight, 123½ pounds (or a gain of nearly 10 pounds); basal metabolic rate +9.7. (The recent cold infection accounts for the increased metabolism.)

Oct. 1, 1925. Has been complaining of indigestion and gastric distress. A gastrointestinal barium meal revealed a hypermobility of the stomach and an enteroptosis. Dietetic measures were used and a ptosis belt for mechanical support. To check the thyrotoxic condition a metabolic reading gave a +6.6 and she had lost only 2½ pounds in weight. The digestive disturbance improved gradually.

March 8, 1927. Within the past year she has grieved over the loss of her mother, but has had no evidence of the former thyrotoxic condition.

The metabolic rate was found to be +1, and she now weighs 127 pounds, or a total gain of 13 pounds.

CONCLUSION

The control of symptoms, reduction in size of gland, increase in body weight and normal metabolism are sufficient evidence to convince the most skeptical of the merits of radium therapy.

ABSTRACT OF DISCUSSION OF PAPERS BY DRS. BOWING AND LOUCKS

DR. GEORGE E. PFAHLER, Philadelphia. I have been very much interested in this subject. About nine years ago I made a report at Atlantic City before the American Roentgen Ray Society on 10 cases of malignant disease of the thyroid. One of these was operated upon fourteen years ago by Dr. Deaver, who said that he could not remove all of the thyroid and knew there was cancer still present. That patient remained well after treatment until three years ago, when she developed some chest symptoms, and on examination I found a metastatic nodule in the lung about an inch in diameter. She later came under the care of Dr. Pancoast and he found many growths in the chest. At that time the patient was given up by her home physician. Later she came to me for treatment and was in a very serious condition. This was six months ago. Today if she walked into this room none of you would think there was anything wrong with her. Symptomatically she is well, but her lungs are still filled with tumors although they are quiescent at present. The point of this is that I believe these tumors are radiosensitive and that we do not have to give up even if the lungs are filled with tumor masses.

Another patient whom I treated by the combined insertion of radium needles and external irradiation with the roentgen ray approximately thirteen years ago, following primary exploratory operation, with a diagnosis made microscopically, is now well and free from disease. Another man lived for seven years and for six years was free from symptoms. During the seventh year he died of a recurrence. This shows the long-continued effect of treatment with the patient dying of metastases. The primary growth never recurred.

Regarding the toxic goiter, I am very enthusiastic about the treatment. We have treated nearly 500 cases with the roentgen ray. I suspect that radium might be better, but we have had such satisfactory results with roentgenotherapy that we have continued with it.

Dr. T. D. Quigley, Omaha, Neb. I assume that Dr. Loucks includes toxic goiter and thyrotoxic adenoma in his paper.

We started treating cases twelve years ago that did not respond to surgery, receiving only those which the surgeon had treated unsuccessfully. We have determined with the passing of the years that not only have we a good remedy for hyperthyroid cases but something that fully equals surgery. We have checked up on the heart, the nervous symptoms, the gastrointestinal symptoms, weight and all the other subjective and objective phenomena we could, and apparently the results have been equal to surgical intervention in every respect. One of the patients we treated had had three surgical operations and three recurrences. Since our treatment she has been perfectly well for nine years. I believe we should either definitely advise patients not to have operations unless they fail to respond favorably to radium treatment, or at least let them choose between surgery and irradiation.

A great many cases of exophthalmic goiter occur in individuals who are starved for iodine, and in my work with some of the poorer class of patients we tried carrying these individuals on iodine for a time to see if we could get a result somewhat approximating our radiation results. We found we could get some improvement in some of the cases but that it did not work as a completely satisfactory remedy. We have had our best results in the cases in which we have used iodine and irradiation together, and in which the patient has been allowed to rest perhaps for three months following the period of treatment, although some individuals get along well without any rest whatever.

One striking feature is that among the private patients we have something over 70 per cent of absolutely satisfactory results, but among the poorer classes, in those individuals who are perhaps starved for the necessities of life and living under bad conditions, we do not get anywhere near the same percentage of good results. The question of nutrition, living conditions, food, clothing and housing all enter into the problem.

Dr. Bowing (closing). I would like to emphasize what Dr. Pfahler has told you concerning the hopeless patient. I am sorry that a review of this kind did not permit a more thorough investigation of individual patients in the group. We have had similar experiences with such patients. The thyroid tumor would respond to treatment and in a few months there would be gross evidence of metastasis to abdominal and thoracic structures. It is of interest that these metastatic growths respond as well as the primary tumor. There is very little, if any, risk attached to irradiation. When dyspnea and dysphagia were present these complications did not increase in severity, but their intensity was usually diminished. When myxedema was present it was not increased with treatment and was controlled with thyroxin. Erythema occurred and, as a prophylactic measure, Dodd's lotion was given to each patient.

The incidence of cancer of the thyroid varies from 1 to 6 per cent; in this group it was 1.9 per cent. Not all adenomas should be removed or irradiated but they should be suspected as a possible source of malignancy and it is better to remove the adenoma and search carefully for malignancy, and if necessary plan a careful irradiation regimen rather than wait for multiple tumors to occur. I am certain that we have something definite and effective to offer to the patient with carcinoma of the thyroid; that is, the combination of surgery, radium and roentgen-ray therapy.

Dr. Loucks (closing). Certainly hyperthyroidism has been considered a surgical condition in the past, and to all newer forms of therapy there is always more or less opposition. Most of the referred thyroid cases come from men who have recognized the good results obtained by irradiation in the last few years. I think it will gradually be recognized both by the practicing physician and the surgeon that many cases can be controlled by radiation therapy.

I wish to emphasize the need of precaution in giving iodine. I have found that patients over twenty-five years of age do not take Lugol's solution well. Many are benefited so that the pulse and basal metabolism will drop but they soon have a relapse.

Some years ago I mentioned before this Society the giving of arsenic in hyperfunctional thyroid cases. As Fowler's solution had been given in chorea to control the muscular spasms I concluded that Donovan's solution of arsenic, which as you know contains a small amount of iodine, might control the tremor and other spastic conditions of toxic goiter, and was pleased to note that many cases which I diagnosed as exhibiting physiological activity due to the absorption from some foci of infection showed a decreased metabolism and a control of symptoms under Donovan's solution. It is given in 1 minim doses in water three times a day after meals for three weeks, then follows a rest period and a repetition of the

arsenic for another three weeks. This therapy can be supplemented by rest in bed, forced feeding, ice bag, etc.

We have had 4 cases of carcinoma and 1 of sarcoma of the thyroid. The case of sarcoma was reported several years ago, because it was a rarity at that time to find a primary sarcoma of the thyroid gland. At autopsy metastases were found everywhere in the body.

Of the 4 carcinoma cases 3 have died. The one living was operated on about four years ago and roentgen therapy was given after thyroidectomy. Two years ago there was an apparent enlargement of the remaining portion of the gland with development of a metastatic lesion in the upper part of the sternum, which was treated with radium. At present the patient is comfortable, without any apparent activity of the gland and without any further malignant extension.

FIVE-YEAR END RESULTS OF RADIUM TREATMENT IN CARCINOMA OF THE CERVIX UTERI*

BY LAWRENCE A. POMEROY, M.D., F.A.C.S.

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IN 1924 Strauss and I reviewed 100 cases of carcinoma of the cervix with special reference to the predominating type of cell.[1] I wish to report an additional 127 cases, making a total of 227, and to describe briefly the present technique and dosage and to consider results in the cases that have been observed for a period of five years or more.

These cases are classified according to the method recommended by the American College of Surgeons:

1. Primary case.
2. Recurrence in vaginal wall following panhysterectomy for cancer.
3. Recurrence deep in pelvis following panhysterectomy.
4. Carcinoma of cervix following supracervical hysterectomy.

A. Disease limited to cervix.
B. Disease involving uterine cavity or vaginal wall.
C. Disease involving broad ligaments.
D. Wide fixation. Remote metastases.

In most of the cases where the vaginal wall is involved the broad ligaments are also involved and vice versa, so that the cases of Groups B and C are classified together.

In the microscopic pathological diagnosis the classification of cell types suggested by Martzloff[2] is used.

1. Spinal Type of Cancer Cell.
   - I. Polyhedral.
   - II. Well-defined outlines.
   - III. Nuclei stained moderately.
   - IV. Abundant cytoplasm, with pale eosin stain.
2. Transitional Type of Cancer Cell.
   - I. Round.
   - II. Faint cell membranes.
   - III. Nuclei stained well with hematoxylin.
   - IV. Cytoplasm less abundant and stained well with eosin.
3. Fat Spindle Type of Cancer Cell.
   - I. Long and comparatively broad.
   - II. Faint cell membranes.
   - III. Nuclei deeply stained with hematoxylin.
   - IV. Cytoplasm small in amount and eosin stained.

In addition the presence or absence of epithelial pearls is noted by Martzloff. It is Martzloff's conclusion that the spinal cell type is the least malignant and the fat spindle cell type the most malignant, tumors of the adenocarcinoma and transitional cell type occupying an intermediate position. In a general way, the spinal cell type of Martzloff corresponds to the squamous cell type of Schmitz,[3] and to Grade I of Broders.[4] The fat spindle cell type of Martzloff in a similar way corresponds to the unripe basal cell type of Schmitz, and to Grade IV of Broders.

I should like to emphasize one statement made by Strauss[1] and myself in 1924, as follows: "One complicating factor should be kept clearly in mind in considering cases treated by radium. At any rate in theory, the least malignant cells are the least radiosensitive, and the most malignant cells are the most radiosensitive. Changes in the relative value of these opposing factors help to explain some of the results

* Read at the Twelfth Annual Meeting, AMERICAN RADIUM SOCIETY, Washington, D. C., May 16–17, 1927.

that would otherwise be difficult to understand."

In the early part of this series of cases, the patients were treated by the intrauterine application of screened radium element and by the insertion of steel needles containing radium element directly into the tissues of the cervix. In these cases the dosage was usually about 3000 mg-hr. In spite of some changes of technique and some increase in dosage the entire series may be considered as a whole because the principles underlying the application of radium have been the same.

The technique in use at present may be described briefly as follows: The patient is given a general anesthetic, usually nitrous oxide, and a thorough pelvic examination is made. If possible a biopsy is performed, but is practically never repeated. If a piece of the cervix is removed for biopsy an old fashioned tonsil punch, as recommended by Crossen[5] is used (Fig. 1). The wound left by the removal of this small piece of tissue is usually not sutured or cauterized. A moderate amount of blood and lymph oozing from this wound may tend to wash out loose cancer cells as suggested by Ewing.[6] If there is much destruction of the cervix and only a crater is left a specimen can usually be obtained with a curette. The cervix is carefully dilated and the length of the uterine canal measured. The uterine cavity is curetted in order to obtain an additional specimen for microscopic examination. One or more tubes of radium element screened with 0.5 mm. silver, 1 mm. brass, and 1.5 mm. rubber, are then inserted, care being taken to irradiate the entire length of the canal from the fundus to the external os (Fig. 2). A fairly typical dosage is 75 mg. thus distributed, for a period of 36 hr., making 2700 mg-hr.

In addition the cervix is implanted with seeds of radium emanation, the exact number depending upon the size of the cervix. Either glass or gold seeds are used for this purpose for it seems to make little difference which kind is used except when they must be implanted close to the bladder or rectum, or high up toward the broad ligaments. In these locations the gold seeds are preferred.

In implanting these seeds it is customary to consider the cervix as the face of a clock and to implant one row deeply at locations corresponding to the markings for the odd hours, another more superficial row corresponding to the even hours and, if a third row is used, to implant these at locations corresponding to the odd hours (Fig. 3). A fairly typical dosage consists of twelve 1 mc. glass seeds implanted in this manner. The dosage of emanation thus implanted is 12 times 132 or 1584 mc-hr. If this is added to the dosage of

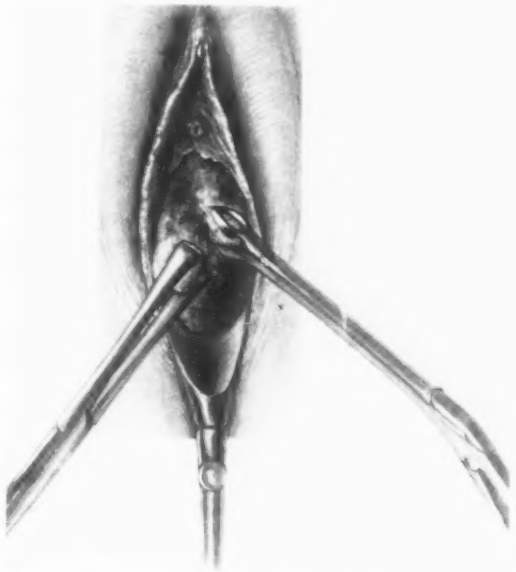

FIG. 1. Removal of piece of cervix for microscopic examination.

screened radium in the canal the combined dosage may be represented by 4284 mg.- and mc-hr. The maximum dosage employed in this series of cases is about 6000 mg.- and mc-hr. After the radium has been applied the vagina is packed very tightly with gauze, great care being taken to surround the cervix with gauze and to pack tightly enough to push the vaginal walls well away from the cervix. If this is done thoroughly there is much less likelihood of distressing rectal and vesical tenesmus.

Such a treatment is not repeated for several months, if at all. Occasionally a small nodule remains and this may be treated by the insertion of one or two seeds a few months later. Occasionally,

but very rarely, the application of intrauterine screened radium may be repeated.

Most of these patients have been treated by radium alone. In the cases of Group 1A, if the result of the application of radium to the cervix has been good, the roentgen ray has occasionally been used after a lapse of several weeks in an effort to reach the deeper structures of the pelvis. In the advanced cases it seems that the full palliative effect can be obtained by radium alone without the added discomfort which often follows the roentgen-ray treatment. Of the cases apparently well after five years, 4 out of 5 were treated by radium alone. In the fifth case roentgen radiation was to be used in addition to the radium but the patient did not return for the full course of treatments. Therefore all these cases may be considered as if treated by radium alone.

In our first 100 cases Strauss[1] and I reported that 21 per cent of the patients had borne five or more children. In the second 127 cases 23.6 per cent of the patients had borne five or more children, making a percentage of 22+ per cent for the entire series. In reporting the first 100 cases we emphasized the fact that

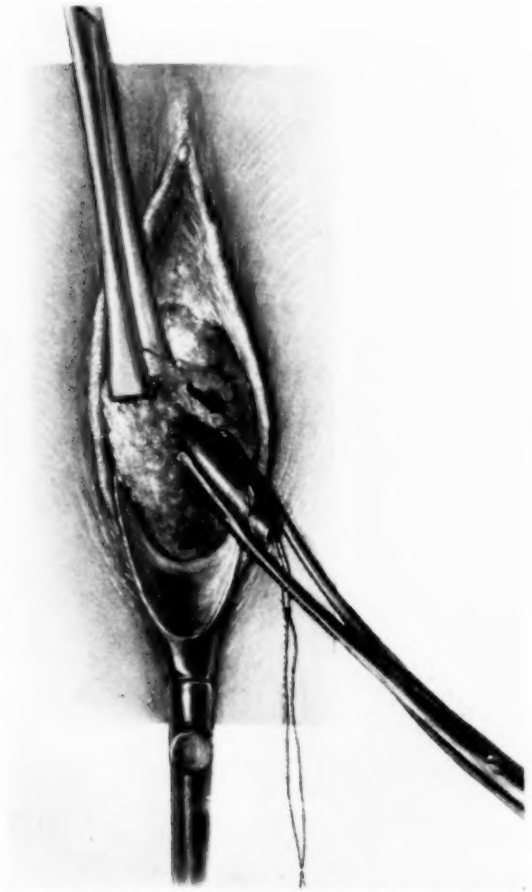

Fig. 2. Insertion of screened radium element in uterine canal.

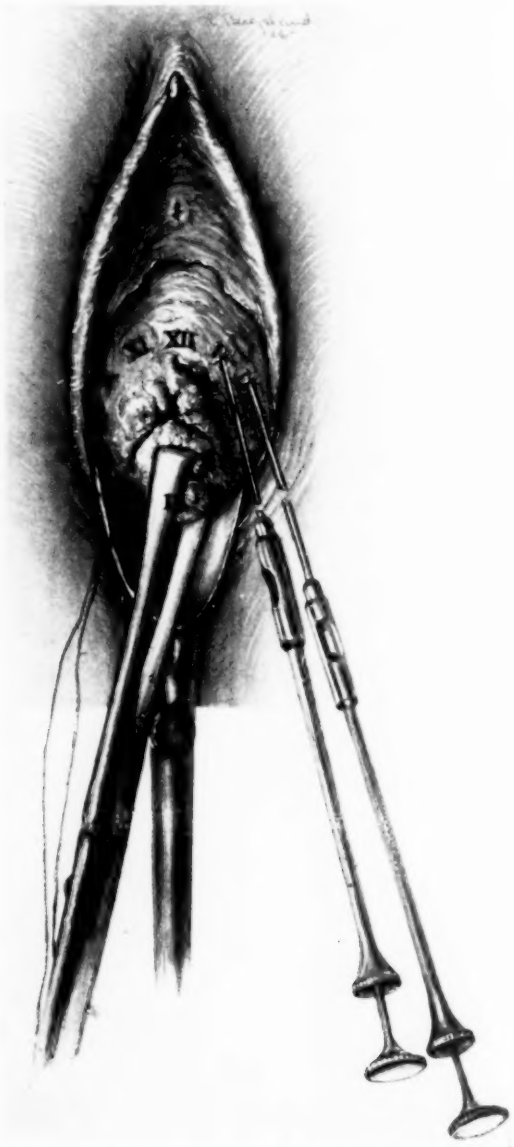

Fig. 3. Implantation of cervix with seeds of radium emanation.

10 per cent of the patients had never been pregnant. This observation seems to be confirmed by the more recent cases as 9.44 per cent of 127 patients had never been pregnant. This makes 10— per cent of the 227 patients who had never been pregnant. It is also interesting to note that of these 227 patients 10, or 4.4 per cent, were below thirty years of age. The youngest patients treated were twenty-six years old, 3 being of this age.

The following results are based on cases observed for five years or more. Of 29 cases of microscopically proven carcinoma of the cervix treated with radium 5 patients are apparently well after five years. These 29 cases include all classes from the early to the far advanced and from those with small local involvement to those with frozen pelves. This makes 17.24 per cent apparently well after five years. Of these 5 cases, 4 are classified as IA, and the fifth as IB-C, there being apparently involvement of the vaginal wall and the broad ligaments at the time this patient was first seen. Of these 5 cases, 3 are classified as adenocarcinoma type, one as spinal cell type without pearls, and one as transitional cell type.

Of 5 cases originally classified as IA, 4 patients are alive and apparently well after 5 years, the one patient not surviving being classified as spinal cell type without pearls. These 5 cases originally classified as IA constitute such a small group that it is well not to talk in percentages but it can be said of this group, representing the definitely operable type according to old standards, that 4 out of 5 patients are apparently well after five years.

CONCLUSIONS

1. In a series of 227 cases of carcinoma of the cervix applying for radium treatment 29 cases microscopically demonstrated as carcinoma have been observed five years or more. Of these 29 cases, representing all grades of severity, 5 or 17.24 per cent of the patients are apparently well.

2. Tumors classified as adenocarcinoma of the cervix constitute over half of these apparently arrested cases.

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DISCUSSION

Dr. W. P. Healey, New York City. The paper to which we have just listened represents the carefully supervised work of a single institution, and probably a limited number of men, two or three, over a period of five years, during which they have endeavored to obtain a uniform plan of study and treatment for their cases. At the Memorial Hospital we have been following our cases for a long time. The work was begun by Dr. Bailey in 1916, and continued by him until 1921. We still follow his classification, which is early, borderline and advanced. We also have another group which is far too advanced for anything but palliative treatment. In that group we cannot hope to eliminate the disease.

As to the method of treatment, we follow very essentially the crossfire method he instituted of placing radium in capsules in the cervical and lower uterine cavity. We use about two capsules as a rule, one in the cervix, and one just above the internal os. It is interesting to note, I think, that over the long period of years, since 1915, the occurrence of pyometra in any of our cases subsequent to irradiation of the cervix has been so very infrequent that I feel it can be ignored. In other words, the intensive dosage we use seems to bring about a complete disappearance of the endometrial tissue. On the other hand, it has been emphasized constantly that we very infrequently observe carcinoma of the cervix invading the uterine body, going above the internal os. This is very rare and we have found that one capsule placed just above the internal os is sufficient. We use also a vaginal applicator, applied across the cervix, and the base of the broad ligament on each side and give a fairly large dose. We have used since 1922, the roentgen ray for external crossfire of

the entire lymphatic drainage area of the pelvic field. Dr. Bailey used radium packs, but the amount of radium we had was so small that I felt we could do better with roentgen rays for the external application. In addition to these three surface methods of crossfire, we now use the interstitial application of gold seeds containing emanation. I use these only to equalize the therapeutic effects of the radium throughout the tumor, because practically none of our patients present a symmetrically located lesion around the cervical canal. The lesion usually goes one-half or two-thirds of the way around the cervix, being much more extensive on one side than on the other.

It is very unusual for our patients to receive less than 6000 mc-hr. The capsules placed in the cervical canal will rarely be placed for less than 3000 mc-hr., and the seeds will increase this dosage 500 to 2000 or 2500 mc-hr.

Our records show that many of the patients have received 7500 mc-hr., and that has all been given within forty-eight hours, as a rule. The primary treatment is heavy and is practically the only treatment the patient receives for six weeks. Then as a routine, we refer the patient to the roentgen-ray department for a high voltage pelvic cycle. Formerly we used the low voltage pelvic cycle, but at that time we were not using the seeds. We employ the roentgen rays in an effort to take care of the almost inevitable recurrence which takes place in a majority of cases in the outlying portions of the pelvis, where we think there is little effect from the radium. This completes our treatment.

As to the cell type, we have been absolutely unable to obtain any advantage whatever which would guide us in the handling of these cases by study of the histological specimens removed. Dr. Ewing grouped them according to Broders' classification and we find that 72 per cent fall in the transitional group; 14 per cent in the least malignant group and 14 per cent in the most malignant, and we have a very few adenocarcinomas of the cervix, only 2 per cent. When we say that 72 per cent fall in the transitional group one realizes that some of the cells are 2 minus and some 2 plus, but it does not seem to make the slightest difference whether they are Group 1, 2 or 3, according to our records, as regards end results.

As to prognosis, we are of the opinion that the most important factor is the extent of the local disease, when the patient comes under observation, and that next to that is the ability of the patient, when she receives some help, to take control of the situation and hold it in abeyance.

Now, as to statistics. Taking Dr. Bailey's 1921 group, this gives us five-year cases treated only with radium. Of the early cases, 60 per cent are living and well. Of the borderline cases, 56 per cent; of the advanced cases, 9 per cent are living and well. Of the recurrent cases 16 per cent of those that came to us after being treated elsewhere by operation are still alive and in good condition. I cannot say whether they are free from cancer, but they report to the clinic in good condition. We count every patient as dead that we cannot locate.

DR. G. E. WARD, Baltimore, Md. We have made several studies at the Howard A. Kelly Hospital in Baltimore, and a year ago reviewed all of these, adding the cases treated in 1921 and 1922. Recently I reviewed this last group, bringing the data up to the five-year period.

Our statistics closely parallel those of Dr. Pomeroy. Type I yields best to irradiation therapy and not to operation. The squamous cell Types II, III and IV, are not so sensitive to irradiation, as they are adult cells, and therefore yield better to operation than to irradiation in most instances.

In our latest series of 232 cases, we have 14 which were clearly operable on admission. Of these, 50 per cent are living and well after five years. Of those that were sent by a surgeon requesting irradiation, as a preparation for operation, there are 25 per cent past the five-year period. In this group, 50 per cent were well when last heard from, but only 25 per cent can be traced by the five-year period. Those recurrent after operation, number 41, out of which 14 are today living and well. When last heard from 22 per cent were living and well but 6 per cent could be traced past the five-year period. We had only 2 who were sent for prophylactic treatment and they could not be traced past the five-year period, but were well when last heard from.

In the borderline group in which we were doubtful as to whether operative treatment could be carried out, there are 10 per cent living and well. In another group of 7, cauterization was either done by the referring surgeon as an emergency measure on account of excessive bleeding, or after the patient came to the hospital because of the excessive size of the growth, the cautery being used to remove a portion of the growth in order to carry out radiation therapy nearer the margins of the tumor. Of these only 28 per cent have been followed past the five-year period.

The last group, which was the largest and to me intensely interesting, was made up of totally inoperable cases. It seems important to consider these because for several years we have heard much about cancer propaganda and yet 141 of these cases came to the hospital in a totally inoperable condition. In this group 5 per cent are well, and 4 per cent have passed the five-year period. Of these 13 well patients, 7 have been traced past the five-year period.

Our technique is as follows: We use, as a rule, one or two tubes of radon in the cervical canal and a plaque against the cervix to crossfire the growth. The tubes are made of brass 1 mm. in thickness containing a glass bead filled with emanation. We do not irradiate the uterine cavity, believing that efficient crossfiring may be obtained by treating in and on the cervix. With this technique pyometra is very rare. We reserve the use of the gold radon points for the cases with lateral extension and where the cervix is very large. Tissue examination is routine. We have a small type of rongeur forceps for clipping a bit of tissue from any ulcerative lesion. This is in no way injurious, but aids materially in gauging doses and technique.

I am a little surprised that the dosages mentioned have been so heavy. We usually give at the first treatment between 2500 and 3000 mg-hr. If there is still evidence of disease at the end of six weeks, we repeat the dosage, or sometimes crossfire the parametrium with roentgen rays or radon packs through two portals anteriorly and posteriorly. We feel that the clinical classification for determining dosage is much better than microscopic classification alone. It is always best, however, to compare both microscopic and clinical findings. Large fungating growths require a much larger treatment than the small ones within the canal, although the histological findings may be the same.

Dr. Henry Schmitz, Chicago. Last year we reported a study of the histological classification of carcinoma of the cervix and showed by follow-up statistics that we are very well able for the purpose of prognosis, and not for the purpose of treatment, to foretell the probable end-result of treatment. We had four degrees of histological malignancy, which correspond to Broders' classification of Grades 1, 2, 3, and 4. We considered several factors such as irregularities in size and shape of nuclei and cells, predominant type of cell, prophases and mitoses, hyperchromatism, etc. This work agreed well with that done by Broders and Greenough.

Another observation made was that the type cell cannot be used in the determination of the degree of malignancy. We should not forget that the importance of the histological classification is simply one of prognosis and not of treatment.

Dr. Pomeroy (closing). We feel that irradiation of the entire uterine canal from fundus to external os and the consequent destruction of the whole uterine mucosa lessens the chance of a contraction of the cervix with retention of pus inside of the uterus.

Dr. Ward brought up the question of biopsy. We do a single biopsy but do not repeat it, much as we would like to know just what changes are taking place in the cells that we are treating. I have always remembered that Heyman of Stockholm reported his most disastrous results in the cases in which he did repeated biopsies.

As Dr. Schmitz has stated, the classification according to cell type is for the purpose of prognosis and we have not yet varied our dosage according to the cell type. I think that any classification must include the gross findings as well as the cell type. In our experience a large cauliflower cervix filling a large part of the vagina is much more amenable to treatment than one where the process is destructive and but a small portion of the cervix remains.

THE EFFECT OF ROENTGEN IRRADIATION ON THE VELOCITY OF ERYTHROCYTE SEDIMENTATION *

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IT has been observed that when roentgen rays are applied to test tubes containing suspensions of citrated blood, the velocity with which sedimentation of the erythrocytes takes place differs from that occurring in non-irradiated blood. Since the phenomenon of erythrocyte sedimentation is associated with various physicochemical changes in the blood such as the ability of flocculation of the plasma and serum,[1] the volume of erythrocytes,[2] the electrical conductivity of the blood,[3] and with certain hydrodynamical factors,[4] the alterations in the rate of sedimentation of the erythrocytes following irradiation have been attributed to the biological effects of the roentgen rays on the blood. In view of these findings, it was suggested that the test offered a means of estimating the biological action of irradiation *in vitro* for which no satisfactory method has as yet been devised. But in spite of the ease of determining possible changes that irradiation produces on the velocity of erythrocyte sedimentation, it is still undecided whether or not irradiation retards, accelerates, or has no effect on sedimentation. Von Mikulicz-Radecki[5] noted that the velocity of erythrocyte sedimentation of irradiated blood was decreased. Pohle's publications[6,7] substantiate these observations. He also obtained more or less definite retardation in the velocity of erythrocyte sedimentation as a result of roentgen irradiation. Jaller,[8] on the other hand, found no change in sedimentation following roentgen irradiation. More recently Brummer[9] obtained entirely different results, finding that roentgen irradiation increased the velocity of erythrocyte sedimentation. The present study was therefore undertaken to determine which of the above mentioned investigators was correct in his conclusions.

METHOD

There are two recognized methods of recording the erythrocyte sedimentation reaction: one is by noting the time that elapses for the uppermost layer of erythrocytes to pass a measured distance in a graduated test tube (Linzenmeier method), the other, by noting the distance which the uppermost layer of cells has settled in a given period of time (Westergren method). The advantages and disadvantages of each method have been discussed by others. From several years' experience which one of us (R) has had with the test, it was decided that a modified Westergren technique would best serve the purpose of this investigation. By our method we have taken into account several sources of error that may explain the divergent results obtained by the investigators mentioned previously.

The details of our method are as follows: 2 c.c. of a 3.8 per cent solution of sodium citrate was drawn into a sterile 10 c.c. Record syringe. From a vein of the forearm, blood was drawn into the syringe to the 10 c.c. mark, giving a dilution of 1:4. After the withdrawal of the blood, a metal stopper having a small opening was substituted for the needle. The blood was then thoroughly mixed by gently inverting the contents for several minutes, the fingers being held tightly to both ends of the syringe. The precaution was taken not to shake the mixture. The citrated blood was sucked up directly from the syringe into twelve thin glass tubes which were placed in two test tube racks in the following manner: One tube was first placed on the rack to be irradiated and then one on the control rack. This procedure was repeated until each rack contained six tubes which were kept in place by elastic bands. The average time taken to fill and arrange the twelve tubes was five minutes. One rack of tubes was then placed at a measured distance from the focus of the roentgen-ray tube preparatory to irradiation, the machine* having

* We used a Waite and Bartlett 250 kv. transformer with a mechanical rectifier and a Coolidge deep therapy tube with tungsten target for our experiments. The doses applied were measured by ionization in electrostatic or roentgen units according to the method formerly described.[10] The quality is given in Christen's half-value layer.

* From the Montefiore Hospital, New York City

been previously adjusted. As a control, the other rack with its tubes was in the same room but protected with lead screens. As soon as the tubes were filled with blood and arranged in position, irradiation was begun. In one experiment a photographic film was placed on the control rack of tubes to make sure that the control tubes were not subjected to irradiation. A level was also used to secure a vertical position of the stands.

Readings were also made at various intervals up to the twenty-fourth hour at which time sedimentation is practically completed. The small variations that were occasionally encountered in the heights of the blood columns were minimized by using the ratio of the height of the clear plasma layer to the total height of the blood column in making the final calculations. In these experiments the blood of both healthy and tuberculous individuals

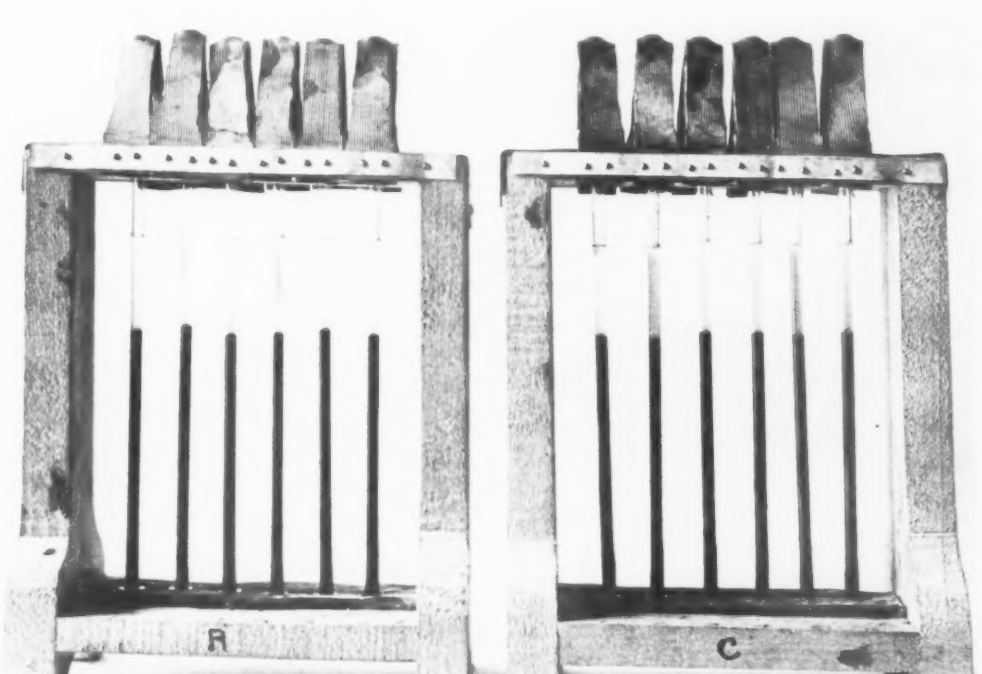

FIG. 1. Appearance of the irradiated and control stands at the end of one and a half hours of irradiation with filtered rays.

The twelve test tubes used in the experiments were made from a single glass tube so that each had the same absorptive value. Each tube was also calibrated separately. The citrated blood was drawn into each tube to a mark corresponding to a distance of 100 mm. The tubes and racks are shown in Figure 1, and it will be noted that sedimentation had already proceeded to some degree.

For the first two hours readings were made of the clear plasma layer with a millimeter scale every five minutes, and in some experiments every ten minutes. was used to obtain a wide range of sedimentation velocities.

EXPERIMENTAL

1. *The Effect of Unfiltered Radiation on the Velocity of Erythrocyte Sedimentation (Table I).*

It was found that unfiltered roentgen radiation caused an increase in the velocity of erythrocyte sedimentation, and the degree of this increase and the periods during which irradiation produced its maximum effect depended upon the initial sedimentation velocity of the blood. Blood

TABLE 1

THE EFFECT OF UNFILTERED RADIATION ON THE VELOCITY OF ERYTHROCYTE SEDIMENTATION

Time Rad. Begun, Min.	Case 1			Case 2			Case 3		
	Rad., Mm.*	Cont., Mm.	Diff., Mm.	Rad., Mm.	Cont., Mm.	Diff., Mm.	Rad., Mm.	Cont., Mm.	Diff., Mm.
5	0.4	0.7	−0.3	1.3	1.7	−0.4	5.7	3.3	+2.4
10	1.8	2.7	−0.9	9.9	7.6	+2.3	20.8	16.7	+4.1
15	5.9	6.4	−0.5	24.7	17.8	+6.9	37.0	30.3	+6.7
20	9.9	11.1	−1.2	37.2	28.4	+8.8	48.2	41.7	+6.5
25	16.8	15.4	+1.4	47.2	37.8	+9.4	55.6	50.0	+5.6
30	21.6	19.7	+1.9	52.5	45.5	+7.0	58.7	55.5	+3.2
35	25.3	23.1	+2.2	55.0	51.2	+3.8	60.1	58.3	+1.8
40	28.5	25.8	+2.7	55.8	53.9	+1.9	60.9	59.6	+1.3
45	31.0	28.3	+2.7	56.5	55.4	+1.1	61.6	60.3	+1.3
50	33.2	30.1	+3.1	57.1	56.7	+0.4	61.9	60.9	+1.0
55	34.6	31.6	+3.0	57.7	57.4	+0.3	26.5	61.5	+1.0
60	36.0	33.3	+2.7	58.0	58.0	+0.0	62.7	61.6	+1.1
				Radiation Stopped					
Hrs. 24	48.7	48.7	±0.0	62.0	62.0	±0.0	65.6	65.4	+0.2

Kv. = 130
Ma. = 5
Focal distance = 30 cm.
Intensity = 1.5 R/sec. (erythema time = 4½ min.)
Quality = 1.8 mm.
Al. half-value layer

* Mean average of readings in pipettes.

in which a moderate acceleration of sedimentation occurred gave the greatest actual increase following irradiation when compared with the control. It was also noted that the effects of irradiation became manifest sooner but were more transient in rapidly sedimenting blood than in blood with slower sedimentation velocities. As will be shown later, these changes were not caused by the action of the roentgen rays *per se* but rather by the heat evolved in the process of irradiation. However, the results are of sufficient interest to warrant discussion.

In a previous communication,[2] it was noted that in early periods of sedimentation there is greater opportunity for interplay between plasma and cells and that at this time the plasma is the more active participator in the process. As sedimentation progresses, the reaction becomes more and more an expression of cell volume so that at the end of twenty-four hours, at which period sedimentation is practically complete, the cell layer bears a fairly exact ratio to the corpuscular volume in the blood specimen. Unless the action of irradiation can be attributed to an effect on the cells rather than the plasma, it must take place rapidly and become apparent early in the process of sedimentation. That the former case is doubtful is seen by a comparison of the twenty-four hour readings of the irradiated and non-irradiated blood, there being practically no difference between them.

When the sedimentation velocity was moderately accelerated there was the greatest active increases with unfiltered radiation for somewhat similar reasons. When sedimentation was of moderate celerity, there was a longer period elapsing before the influence of the erythrocytes became manifest and the active process of sedimentation was under the influence of radiation for a longer duration. In rapidly sedimenting blood, 90 per cent of the process of sedimentation may take place in as short a period as fifteen minutes, depending to some extent also upon the size of the blood container; therefore, it becomes apparent that blood of rapid sedimentation does not show such marked differences in rate following irradiation as blood of moderate sedimentation velocities. It can be also readily understood from the nature

TABLE II

THE EFFECT OF FILTERED RADIATION ON THE VELOCITY OF ERYTHROCYTE SEDIMENTATION

Time Rad. Begun, Min.	Case 1			Case 2			Case 3		
	Rad., Mm.*	Cont., Mm.	Diff., Mm.	Rad., Mm.	Cont., Mm.	Diff., Mm.	Rad., Mm.	Cont., Mm.	Diff., Mm.
5	0.3	0.5	−0.2	1.4	1.3	+0.1	2.2	1.8	+0.4
10	1.2	1.8	−0.6	4.3	4.7	−0.4	7.5	7.1	+0.4
15	2.7	2.7	±0.0	8.4	9.0	−0.6	16.7	15.6	+1.1
20	4.0	3.9	+0.1	12.3	13.0	−0.7	26.3	23.9	+2.4
25	6.2	6.1	+0.1	16.5	17.8	−1.3	31.6	30.8	+0.8
30	8.2	8.7	−0.5	19.9	20.2	−0.3	36.8	35.2	+1.6
35	10.3	10.5	−0.2	22.9	23.3	−0.4	40.6	38.9	+1.7
40	12.4	12.4	±0.0	25.7	26.1	−0.4	43.6	42.5	+1.1
45	15.8	15.7	+0.1	28.0	28.5	−0.5	46.0	44.5	+1.5
50	18.5	18.4	+0.1	30.2	30.5	−0.3	47.6	46.2	+1.4
55	20.5	20.3	+0.2	31.6	31.8	−0.2	49.3	48.0	+1.3
60	22.8	22.1	+0.7	32.7	33.4	−0.7	51.1	49.6	+1.5
Radiation Stopped									
Hrs.									
2	32.4	31.8	+0.6	38.0	38.5	−0.5			
3	37.9	37.6	+0.3	40.1	41.4	−1.3	62.3	61.9	+0.4
4	40.2	39.9	+0.3	....	....	....	65.1	64.8	+0.3
5	42.3	42.1	+0.2	41.4	42.2	−0.8			
6	43.7	43.3	+0.4	41.9	42.7	−0.8			
24	52.5	51.7	+0.8	47.0	47.6	−0.6	67.3	67.1	+0.2

Kv. = 130 Filter = 1 mm. aluminum
Ma. = 4 Intensity = 0.42 R sec. (erythema time = 25 min.)
Focal distance = 40 cm. Quality = 3.5 mm. Al, half-value layer.

* Mean average of readings in six pipettes.

of the process that there will be less influence exerted by irradiation upon blood of slow sedimentation in spite of the fact that a longer time elapses before sedimentation is completed. The factors that bring about an increase in the velocity of erythrocyte sedimentation function less in slowly sedimenting blood, therefore irradiation cannot have much effect on blood whose plasma is naturally deficient in sedimenting power.

2. *The Effect of Filtered Radiation on the Velocity of Erythrocyte Sedimentation* (*Table II*).

In contrast with the results of the previous experiments filtered radiation had practically no effect on the velocity of erythrocyte sedimentation. The actual differences between the irradiated and control blood were slight. Moreover, the irradiated specimens as often showed decreased velocity of sedimentation as increased velocity so that the slight variations were probably due to technical factors which will be discussed later.

3. *The Effect of Heat of Irradiation on the Velocity of Erythrocyte Sedimentation.*

In the previous experiments no records were kept of the temperatures of the irradiated and non-irradiated blood specimens. The negative results with filtered radiation suggested the possibility that the increased velocity of erythrocyte sedimentation which was noted with unfiltered radiation may have been due to the heat generated by the roentgen tube and not to the roentgen rays *per se*. Since it is well known that heat causes an increase in the velocity of erythrocyte sedimentation the matter was further studied in the following manner:

In three experiments a cardboard was interposed between the roentgen tube and the stand and the blood irradiated with a dosage of 1.5 R-units per second for four consecutive periods of five minutes each, readings being taken at the end of each five minutes of irradiation. The cardboard was then removed, the irradiation continued and readjusted so that the dosage was again 1.5 R-units per second with the same radiation quality. The effects on sedimentation were noted every ten minutes and for various other time intervals.

Thermometers had been adjusted to the sides of the irradiated and control racks and at each series of readings note was made of the temperature. The results of such an experiment are reproduced in Table III which also shows the temperature records.

TABLE III

THE EFFECT OF HEAT FROM THE TARGET OF THE ROENTGEN-RAY TUBE ON THE VELOCITY OF ERYTHROCYTE SEDIMENTATION

Time, Min.	Rad., Mm.*	Temp., °C.	Cont., Mm.	Temp., °C.	Sed Diff., Mm.	Temp., Diff., °C.
	Radiation Begun—Cardboard in Place					
5	0.3	27.1	0.3	27.3	±0.0	−0.2
10	1.6	27.1	1.7	27.1	−0.1	±0.0
15	2.8	27.1	2.9	27.1	−0.1	±0.0
20	4.6	27.1	4.7	27.1	−0.1	±0.0
	Cardboard Removed—Radiation Continued					
30	9.0	29.2	8.1	27.3	+0.9	+1.9
40	13.3	30.0	11.6	27.8	+1.7	+2.2
50	17.0	30.0	14.6	27.6	+2.4	+2.4
60	19.8	30.0	17.5	27.8	+2.3	+2.2
70	22.3	30.0	19.8	27.8	+2.5	+2.2
80	24.1	30.3	21.5	27.9	+2.6	+2.4
90	25.5	30.6	22.9	27.9	+2.6	+2.7
	Radiation Stopped					
Hrs. 24	46.0	....	45.5	....	+0.5	

* Mean average of readings in six pipettes.

It will be noted that when the temperatures of the irradiated and non-irradiated racks remained the same, no appreciable difference could be detected in the sedimentation velocities in either set of test tubes but as soon as the cardboard was removed there was an increase in the temperature as well as in the rapidity of erythrocyte sedimentation of the irradiated blood. These observations were confirmed by subsequent experiments in which temperature records were kept.

4. *The Effect of Radiant Heat on the Velocity of Erythrocyte Sedimentation* (*Table IV*).

The following experiment lends additional support to the observations that the increased velocity of erythrocyte sedimentation with unfiltered radiation was due to the heat generated in the process. An electric heater was placed at a distance of 1.60 m. from one rack containing tubes filled with citrated blood while another rack and tubes served as control. After several preliminary observations the distance of 1.60 m. was selected so that the tubes were subjected to approximately the same temperature as was produced during the roentgen irradiation experiments.

TABLE IV

THE EFFECT OF RADIANT HEAT ON THE VELOCITY OF ERYTHROCYTE SEDIMENTATION

Time, Min.	Rad., Mm.*	Temp., °C.	Cont., Mm.	Temp., °C.	Sed., Mm.	Temp., °C.
	Radiant Heat Applied					
15	2.2	29.8	1.3	24.0	+0.9	+5.8
30	5.2	29.6	3.5	23.0	+1.7	+6.6
45	9.7	29.6	7.3	23.5	+2.4	+6.1
60	13.0	29.8	9.7	23.8	+3.3	+6.0
75	15.3	29.8	12.1	23.5	+3.2	+6.3
90	18.1	29.8	14.8	24.0	+3.3	+5.8
	Radiation Stopped					
Hrs. 24	49.0	....	49.0	....	±0.0	

* Mean average of readings in five pipettes.

The results confirmed the findings of previous experiments, namely, that a slight increase in heat was sufficient to increase the velocity of erythrocyte sedimentation.

5. *The Effect on Erythrocyte Sedimentation of the Interval of Time Taken to Fill the Test Tubes* (*Table V*).

Although the time taken to fill and arrange the twelve test tubes rarely exceeded five minutes, or approximately thirty seconds for each tube, this factor was also taken into consideration in our experiments. By first arranging a tube on the rack used as a control and then one on the stand to be irradiated and by reversing the sequence in other experiments, the source of error due to the element of time was greatly reduced, especially when the mean average for the readings of each rack was used in the calculation of the final results. When only two tubes are used, one for irradiation and the other for control, the time factor is a source of considerable error as Table v will show. In such a procedure the first tube that is filled and set up begins to show evidences of erythrocyte sedimentation almost at once and with blood of rapid sedimentation rate an initial start of even thirty seconds may influence the results.

In the accompanying table (Table v) there is reproduced a protocol of an experiment which illustrates this effect.

TABLE V

THE EFFECT OF THE TIME TAKEN TO FILL AND ARRANGE THE PIPETTES ON THE VELOCITY OF ERYTHROCYTE SEDIMENTATION

Tube	Col. of Blood	Time 11.0	11.5	11.11	11.19	11.26	11.33	11.40	11.47	11.54	12.0	12.6	12.13	12.20	12.50	2.50	2.50	4.50	24 Hrs.
R							Irradiated Tubes												
	Mm.																		
1	102	2.0	4.0	8.0	10.5	13.5	17.0	20.0	22.5	25.5	28.0	30.6	32.0	34.0	41.5	48.0	52.0	55.0	58.0
2	102	2.0	4.0	7.0	10.0	13.0	16.5	20.0	22.5	25.0	28.0	30.0	32.0	34.0	41.5	47.5	52.0	55.0	57.5
3	100	1.5	3.0	6.0	9.0	12.5	15.5	18.0	21.0	24.0	26.5	28.0	30.0	32.0	39.5	47.0	51.0	53.5	56.0
4	103	1.5	3.0	6.0	9.0	12.0	15.5	18.0	21.5	24.5	27.0	29.5	31.0	33.0	40.0	47.0	51.0	54.0	57.0
5	101	0.0	1.5	4.5	7.5	11.0	14.0	17.5	20.0	23.5	26.0	28.0	30.5	32.0	39.5	46.5	51.0	54.0	56.0
6	100	0.0	1.0	2.0	5.5	9.0	12.5	16.6	19.0	22.0	24.5	27.0	30.0	31.0	39.5	46.5	50.0	53.5	56.0
	101.3	1.2	2.8	5.6	8.6	11.8	15.2	18.2	21.1	24.1	26.7	28.7	30.9	32.7	40.3	47.1	51.1	54.1	56.7
C							Control Tubes												
1	100	1.5	2.5	6.0	9.0	12.5	15.0	18.5	21.0	24.0	26.5	28.0	30.0	32.5	40.0	47.0	51.5	54.0	57.0
2	101	1.0	2.0	6.0	9.0	12.0	15.0	18.5	21.0	24.0	26.5	28.0	30.5	32.5	39.5	46.5	51.0	54.0	56.5
3	102	0.0	1.0	4.5	7.5	11.0	14.5	18.0	20.5	23.5	27.0	28.0	30.5	32.5	39.5	46.5	51.0	54.0	56.5
4	101	0.5	1.5	4.0	6.5	10.5	13.5	17.0	20.0	23.0	25.0	27.5	30.0	32.5	39.5	46.5	50.5	54.0	56.0
5	102	1.0	2.5	6.0	9.0	12.0	15.5	19.0	22.0	25.0	27.5	29.0	31.0	33.5	40.0	46.0	51.0	53.5	56.0
6	100	0.5	2.0	5.0	8.0	11.0	14.5	17.5	21.0	24.0	26.0	28.5	30.0	32.5	39.5	46.0	50.0	53.0	55.5
	101	0.8	1.9	5.3	8.2	11.5	14.7	18.8	20.9	25.6	26.3	28.2	30.3	32.7	39.7	46.4	50.8	53.8	56.3

Radiation begun at 10.52 A. M. Order of filling R_1 then C_1; R_2 then C_2, etc.
Kv. = 130
Ma. = 4
Focal distance = 40 cm.
Filter = 1 mm. aluminum
Intensity = 0.42 R/sec. (erythema time 25 min.)
Quality = 3.5 mm. Al, half-value layer

The readings show a decided increase for the first tubes to be arranged in the racks. Thus the first tube in the irradiated rack gave higher readings than the tubes that were filled later and similarly the irradiated tubes show somewhat higher readings than the corresponding control tubes especially at the start of sedimentation. In this experiment R_1 was followed by C_1, R_2 by C_2, etc. Of course there are some exceptions which are due to differences in time necessary for arranging the various tubes since some required more or less time than others.

DISCUSSION

Our investigations fail to substantiate the findings of von Mikulicz-Radecki and Pohle who noted a decrease in the velocity of erythrocyte sedimentation as a result of roentgen irradiation. An increase in the velocity of erythrocyte sedimentation ascribed by Brummer to the effect of the roentgen rays on the electric charge of the erythroeytes is also subject to question in view of our observations that heat can cause such an increase. On the other hand, our results agree with those of Jaller who failed to obtain any biological effect of irradiation upon the velocity of erythrocyte sedimentation. A brief review of the methods that were employed by the various authors will readily reveal the reason for the disagreement.

Von Mikulicz-Radecki's procedure was as follows: 16 c.c. of blood were mixed with 4 c.c. of a 5 per cent solution of sodium citrate, the mixture was divided into two parts; one portion being irradiated, the other serving as control. Both tubes were shaken before sedimentation was begun. The effects of irradiation were noted after an interval of two to three hours. From four such observations he concluded that irradiation caused a decrease in the velocity of erythrocyte sedimentation. There are several objections to his method, the least of which being the shaking of the blood specimens before irradiation was begun and to which Pohle takes exception. It has been found by Berczeller and Wastl,[11] and others that shaking the blood modifies its suspension stability but the greatest sources of error in our opinion are found in von Mikulicz-Radecki's use of only one tube for irradiation and one for control, the insufficient number of experiments and his failure to take frequent readings in the early periods of sedimentation at which time irradiation would be expected to produce its maximum effect on sedimentation.

The micromethod of Linzenmeier and Raunert[12] which was used by Pohle in his experiments can hardly be used with any degree of accuracy for the determination of the effects of irradiation on the velocity of erythrocyte sedimentation. In a micromethod that one of us originally described in colloboration with Morriss[13] the value and limitations of microsedimetry were fully discussed. Linzenmeier and Raunert advocate their micromethod only in cases where Linzenmeier's macromethod cannot be used as in children or adults with small veins or when repeated testing is advisable. Pohle, in his papers, mentions some of the sources of error in the Linzenmeier and Raunert micromethod such as the necessity for free flow of blood, avoiding squeezing the finger, and the possibility of blood adhering to the sides of the capillary tube. There are several other features of Pohle's method which have objections and which minimize the value of his conclusions. His material consisted only of the blood of normal adults, in whom the velocity of erythrocyte sedimentation is naturally slow. The difficulty of demonstrating changes that irradiation may produce on the blood of such individuals has been discussed previously and the inadvisability of limiting one's self to the blood of healthy adults is therefore obvious. Furthermore, Pohle used only one tube for irradiation and one for control as well as unfiltered radiation, without apparently recognizing the effect of heat on sedimentation. His conclusion that irradiation retards the velocity of erythrocyte sedimentation is therefore not justified on the basis of inaccurate experiments.

To a certain extent Brummer's observations agree with ours, although we cannot agree with him in the interpretation of his results. It has been shown by a number of observers that the plasma proteins differ in their stability, as evidenced by their precipitation when various substances are added such as concentrated sodium chloride, tannic acid, aluminum chloride, formalin, and the anions constituting Hoffmeister's anion series. These reagents have been utilized in various nonspecific serodiagnostic tests and depend upon the lability of the plasma proteins in disease as compared to their stability in health. Albumin appears to be the most stable and fibrinogen the most labile of the proteins, the globulins occupying an intermediate position. In conditions in which there is found an increase in the velocity of erythrocyte sedimentation we have also observed that it is easier to precipitate the serum and plasma upon the addition of several of the reagents enumerated above. Brummer utilized the sedimentation reaction by suspending erythrocytes in solutions of citrated blood, defibrinated blood and defibrinated blood washed with physiologic saline and noted the effect of roentgen irradiation upon the velocity of erythrocyte sedimentation in these suspension media. He found that irradiation caused the greatest increase in the velocity of erythrocyte sedimentation of citrated blood, i.e., blood containing the fibrinogen component, a lesser increase in defibrinated blood and practically no change in the sedimentation velocity of cells suspended in saline solution.

Brummer concludes on the basis of about fifty such observations that the velocity of erythrocyte sedimentation is dependent upon the electric charge of the erythrocytes—Höber's theory—and that irradiation robs the erythrocytes of their electric charge thereby causing them to clump together and as a result to sink faster. His results demonstrate in another manner the greater lability of solutions containing fibrinogen than those lacking this component but this cannot be interpreted as being the result of irradiation since in all likelihood heat alone could have produced similar results.

It is of interest to note that Jaller, whose results agree with ours, used a method that is very similar to the one we employed. She distributed the blood evenly in a number of Sahli test tubes, each being filled with 1 c.c. of blood. Two tubes were kept as control, the others were irradiated. She used a 3 mm. aluminum filter. Readings were taken at the end of one-half, two and three hours. With this method she was unable to show that roentgen irradiation had any effect on the velocity of erythrocyte sedimentation.

We agree with Pohle that the comparison of the sedimentation rate of erythrocytes of patients before and after roentgen treatment with their blood irradiated in test tubes is of too complex a nature to draw any conclusions. It must be added, however, that it is also impractical to make a comparison of sedimentation velocities of patients before and after roentgen treatments since it is encompassed with many sources of error such as the physiologic fluctuations in sedimentation velocities depending on the time of day and the nutrition of the patient; the fluctuations due to pathologic activity if disease is present, and the errors that enter into the performance of repeated tests. A large number of observations on tuberculous,[13] surgical,[14] and cancer patients[15] with macro- and micromethods, some at hourly or daily, others at longer intervals has convinced us of the futility of applying the sedimentation reaction for such a delicate purpose as to demonstrate the possible effects of irradiation by means of this test. The indifferent results of Risse,[16] Klein,[17] von Mikulicz-Radecki, and Pohle can as well be attributed to the extraneous factors enumerated above as to the influence of the roentgen rays on the velocity of erythrocyte sedimentation.

SUMMARY

From our investigations we may conclude:

(1) That the increase in the velocity of erythrocyte sedimentation was due to the heat generated during the process of roentgen irradiation by unfiltered rays.

(2) That when the possibility of heat affecting the reaction is removed there will be no change in the rate of erythrocyte sedimentation by filtered or unfiltered rays.

(3) That any increase in the velocity of erythrocyte sedimentation as a result of irradiation is due to increased temperature and is probably caused by changes in the plasma rather than in the cells.

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THE INACTIVATION OF TRYPSIN BY ROENTGEN RAYS OF DIFFERENT HARDNESS

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THIS investigation attacks a part of the following problem: Is the chemical effect produced by a certain dose of roentgen rays, as determined by an ionization dosimeter, the same whether the rays are hard or soft? The hardness of the rays has been varied by varying the tension from 200 kv. down to 40 kv. The homogeneity of the rays has been secured by the use of different anticathode metals and different metal filters. The indicator of the chemical changes produced by the rays was trypsin from Fairchild Brothers, New York, in a 0.04 per cent solution of pH 5.42. The doses were determined by the ionization produced in air in a small ionization chamber of graphite, the saturation current being determined by an electroscope. It was found that for the range of roentgen rays here examined, within the limits of error the inactivation of trypsin is the same exponential function of the dose.

As a therapeutic method roentgen rays are still looked upon as being somewhat like a poisonous drug of unknown and varying composition. From this point of view that effect of the rays which is measured by a certain dosimeter is in a sense comparable to the part of a drug which is supposed to be medically active.

Among the effects of roentgen rays the ionization of gases, especially that of air, is the most easily measured and therefore is the best known.

If it is assumed that the ionization produces the chemically active part of the products of these "poisonous" rays, then to test this hypothesis it is necessary first to find how much ionization is produced in the system that is affected by the chemical action of the rays, and second, to discover the chemical nature of that action. Such a definition of the nature of the chemical effect may be found by means of different chemical indicators, especially those of a chemically simple nature.

In this presentation we shall discuss only the numerical relation of the dose to the chemical effect on the organic ferment —trypsin.*

The determination of the ionization within the trypsin solution is made by way of an analogy. The ionization of the same gas is found to be proportional to the density of the gas under different pressures. For chemical compounds of the same atoms in the same proportions such, for instance, as formaldehyde CH_2O and sugar $n(CH_2O)$, one may suppose that the ionization produced within a volume of 1 mm.^{3} is proportional to the density. This may be supposed to be the case with a degree of probability which approaches certainty. According to this assumption, in systems composed of light atoms in the same proportions as those in air, viz., O_2, 20 per cent, N, 79 per cent and A, 1 per cent, the same number of ions per unit of weight will be produced as are produced in air. And still further, when in a solution the number of secondary electrons ionized from the absorbing atoms is per gram the same as in air, the ionization is probably the same. Whether or not it is exactly the same or whether there are deviations from the rule can be decided by experiments.

This is a physical point of view of the dosimeter problem.

The experimental part of this work was done in the Department of Biophysics of the Cleveland Clinic Foundation at the suggestion of Dr. Hugo Fricke and forms part of a series of investigations of the relation of the chemical and biological effects of roentgen rays of different wave lengths to the ionization which they produce in air. A considerable amount of work was necessary to develop a technique whereby the effect of roentgen rays on

* The inactivation of trypsin has not been studied, although the ferment is of importance to the process of digestion; nor does this paper pretend to add anything to our knowledge of the chemical nature of this ferment. If any such information may be derived from the figures, it is by mere chance. The many misunderstandings of the purpose of this investigation which I have encountered in verbal discussions of the matter make me wish to emphasize this point.

trypsin could be determined with a sufficient degree of accuracy. The method of analysis is described in another paper. The purpose of this report is to attempt to apply the method to the dosimeter problem, and the findings in this study must be regarded as a preliminary determination. The writer was not able to determine accurately either the ionization or the trypsin concentration because of the long periods of exposure which were necessary. The sources of error are enormously increased when the irradiation is extended over twenty-four hours or more, as will be understood from the figures.

Trypsin was chosen for this study because the papers of Hussey and Thompson[1] had shown that the effect of β-rays on this ferment was comparatively large and that it was reproducible. The many experiments performed by these investigators showed that the inactivation of a 0.04 per cent solution of Fairchild's powdered trypsin is an exponential function of the dose (millicurie-hours), with 50 per cent inactivation after 240 mc-hr. Thanks to several interesting papers by Northrop,[2] and Northrop and Hussey,[3] we have a viscosity method for the measurement of trypsin and of pepsin whereby a comparatively simple and exact determination of the concentration of the ferment in solutions may be made.

During the progress of this investigation Northrop and Clark[4] have published a paper concerning the inactivation of trypsin by roentgen rays of 37 kv. filtered through paper, and from some of their experiments have drawn conclusions of great interest, defining the dose as the number of ions per gram of air.

The present investigation has been carried out in two parts, between which some experiments on the inactivation of trypsin by heat have been made, as well as an investigation of some measurements of the principles of the viscosity method of analysis. Consequently, some important sources of error could be avoided by the use of a constant trypsin standard solution. A systematic use of the viscosity curves improved the method.

The Requirements for Irradiation. Considering the properties of trypsin, the condition of the samples had to answer the following demands:

1. On account of the spontaneous inactivation (Northrop), even at room temperature, the samples had to be kept at zero or near 0°C.*

2. Controls had to be kept under exactly the same conditions.

3. The containers for the samples of the solution of the ferment had to be kept closed to avoid evaporation and contamination by undesired chemical agents produced in the air by the discharge.

4. The irradiated solution had to be exposed in thin layers to diminish the absorption, and it was necessary that it should cover only a small surface in order to avoid the changes of intensity in a large plane field in a very divergent beam of rays.

5. In case many tests were made on a single sample, for different portions of the dose this sample had to be stirred; in case several samples were used, they had to be exchanged so that all received the same dose of roentgen rays.

In all the experiments except in Experiment No. 1, Part 1, the arrangement shown in Figure 1 was used and was found to work satisfactorily. The solution of trypsin was kept floating in sealed dishes of paraffin on the surface of ice water in a big tank. The dishes and their covers were made of a sheet of paraffin 0.9 mm. in thickness, as shown in Figure 1. The dish, which is 3 cm. in diameter and 0.33 cm. thick, was formed in water of about 50°C. by softly pressing the paraffin against a metal block. A cotton string with a small lead sinker was attached to the bottom of the paraffin dish, connecting it to the wheel. When the water wheel w-w was turned around by the ice water current from a pump, the dishes were slowly pulled around by the cotton string, as seen in Figure 1. Control dishes protected from the roentgen radiation by 0.6 mm. of lead shaped into a dish with a loose cover were kept swimming on the same surface by means of cork-floats, which were kept upright by a sufficiently heavy lead keel. Four dishes were usually irradi-

*The spontaneous inactivation of trypsin (Northrop) was not always observed at +2°C. See below in this paper.

ated simultaneously, the controls being kept in a second ring outside.

The roentgen-ray tube was placed exactly above the wheel. When an irradiated sample was taken out, it was replaced by a fresh one. Usually two were taken out at the same time and were analyzed simultaneously.

The hardness was determined by absorption curves in aluminum and copper; and the effective wave length was calculated from Allen's absorption measurements.[5]

Four kinds of radiation were used:

A. 200 kv. 0.37 mm. copper filter $\lambda_{eff} = 0.18$ Å Relative intensity $^1/_4$.

B. 160 kv. 0.37 mm. copper filter $\lambda_{eff} = 0.23$ Å Relative intensity $^1/_8$.

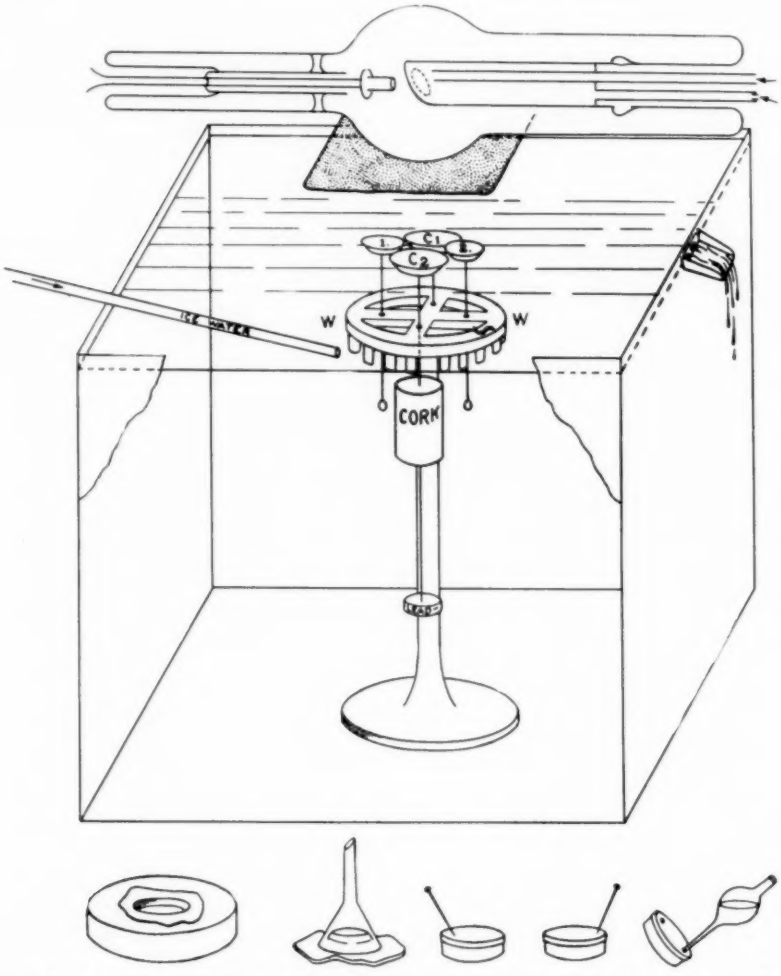

FIG. 1. Schematic drawing illustrating arrangement of apparatus for inactivation of trypsin.

C. 160 kv. 0.12 mm. copper filter $\lambda_{eff} = 0.25$ Å Relative intensity 1.

D. 160 kv. no filter $\lambda_{eff} = 0.45$ Å Relative intensity 1.

I. THE IRRADIATION

A high potential transformer with a mechanical rectifier supplied the voltage.

A broad-focus Coolidge tube with tungsten anticathode was used as the source of radiation.

The voltage was measured by a 12.5 sphere gap, using the calibration of the American Institute of Electrical Engineers.

II. THE IONIZATION MEASUREMENTS.

DOSES

In the first series of these experiments the intensity was measured with a chamber, 20 per cent of the surface of which

consisted of magnesium, 65 per cent of paper, and 15 per cent of amber; the volume of the chamber was 1.04 c.c. The paper was filter paper which had been saturated with india ink and dried. The ratio of ionization in this mixed chamber was determined to 1.58 for about 0.20 A in relation to the ionization in a carbon chamber of 85 per cent graphite and 15 per cent amber. The ionization figures therefore have to be multiplied by 0.63 to be comparable with the ionization figures of the experiments of Part II.

A recent comparison* of the ionization in the graphite chamber with the ionization in air measured in a large chamber has shown that for the radiation employed the ratio is constant.

In the first experiments the capacity of the dosimeter as measured by a high frequency bridge was 3062 m.m.f. = 2750 cm.; and for the dosimeter used in a part of the later experiments (Part II) it was 524 cm. The ratio is 0.191. A comparison of these two dosimeters by readings of the ionization produced in the same chamber by the same roentgen-ray beam gave the ratio 0.198. As the latter is a more direct determination, we have to bear in mind that the dielectric after-effect may be different in the case of high frequency from what it is in the case of slow discharge. However the ratio 0.198 is here used.

In the table the dose is calculated from the hours of exposure divided by the seconds of the discharge period of the electroscope system for a drop of 20.8 volts (saturation current). An average of the ratios is graphically determined.

A correction for the inevitable difference in distance between the anticathode chamber and the anticathode sample is applied according to the usual law of inverse squares; but this is tested experimentally by moving the chamber between the samples and the anticathode.

The absorption in the samples has been directly measured. The intensity at the upper surface $= I_a$.

The intensity at the bottom surface $= I_b$. The correction for absorption is the ratio $(I_a + I_b) : 2I_a$.

The Trypsin Solution. A 0.04 per cent solution of trypsin in an acetate buffer of pH 5.42* was used; 0.1 gr. of Fairchild's powdered trypsin was dissolved in an ice-cold 50 c.c. flask, in 20 c.c. of the ice-cold buffer solution. This was then diluted to 50 c.c. and filtered through two different filters (hardened paper) in an ice box kept at a temperature of 2°C. One volume of the filtrate was diluted with four volumes of the same cold buffer solution.

This solution was tested with β rays in an arrangement similar to that of Hussey and Thompson and in accordance with their experience, as a mean of some experiments, the half-value dose was found to be about 250 mc-hr.†

The analyzing method was the viscosity method of Northrop and Hussey.

The first series of experiments gave a result which is plotted in Figure 2 by a curve in which the logarithm of trypsin concentration represents a function of the dose. This function is most simply described as a straight line. The trypsin concentration at that time, however, could not be very exactly determined and the figures are corrected in a way which was shown to be necessary after a closer examination of the viscosity method. The effective wave length was more sharply defined in the later experiments, but as a consequence of the strong filtration of the rays the intensity was several times less than in the experiments with soft rays in the first series.

The requirements for irradiation of the samples was similar to that used in Part I of these studies, except that the dimensions of the samples were diminished in the ratio of 5 to 3 in order to diminish the field. The thickness of the samples was the same, i.e., 0.33 cm.

Some powerful low tension roentgen-ray tubes with water-cooled anticathodes of different materials which had been developed in this laboratory were used.

* Between 0.2 and ±0.5 within ± 3 per cent.

* pH measurements were made electrometrically in a special apparatus—Hildebrand electrode with a flowing junction between the KCl and the test solution.

† The "Bacto Trypsin" of Digestive Ferments Co., Detroit, Michigan, shows a very marked resistance against d rays. β rays in a dose, which even from rough measurements was calculated to be about 10 times the ionization produced by 240 mc-hr., were tested. A dilute solution of "Bacto Trypsin" of the same activity as the 0.04 per cent solution of Fairchild's powdered trypsin was poured into a glass tube of 4 mm. diameter. A very thin capillary glass tube containing 6 mc. of Ra-emanation was placed coaxially in the solution. No effect on the trypsin could be detected by the viscosity method.

With a focal distance of 12 cm. the intensity corresponded to a half-value

sion voltage were used to give effective wave lengths of 0.72 and 0.58 Å. For

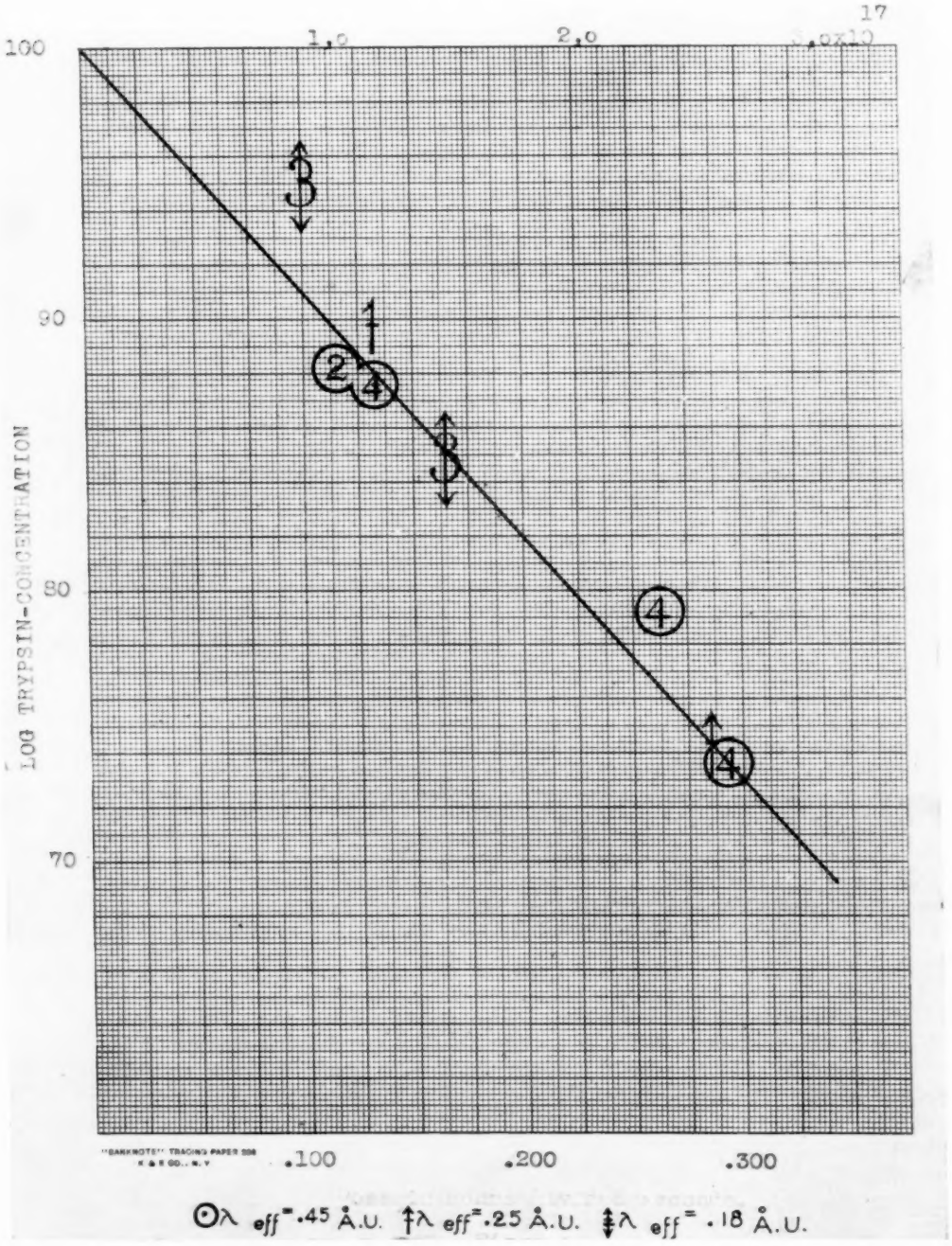

FIG. 2. Dose in pairs of ions per gram air in the large air chamber.

time of the irradiated trypsin of twenty-four hours or more, when filters and ten-

hard rays the old setting of 160 kv., 0.23 Å was used, the effective wave length

being calculated from the absorption in the metal film[5] (radiation table).

The doses were measured with a 1.04 c.c. graphite chamber over the whole area through which the dishes moved and the measurement average was calculated. The deviations never exceeded ± 5 per cent.

In most of the experiments two dishes were given identical doses and were measured separately by comparison with the control. Although sometimes eight to sixteen hours passed between the analyses of two samples which had been given equal doses, in only one case did the analyses differ more than 2 per cent. In one case the period of inactivation was extended over twenty hours, but usually it lasted for but ten hours.

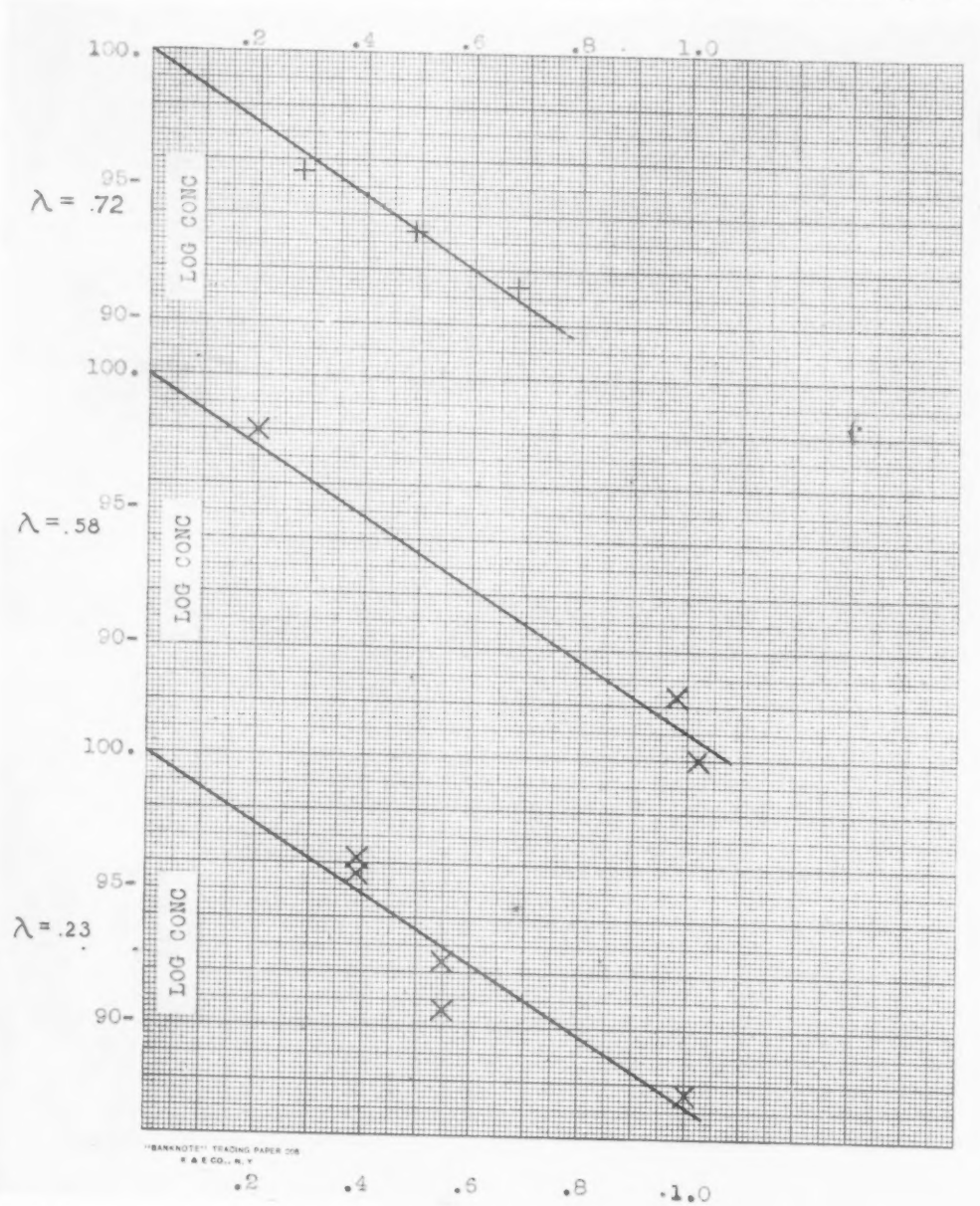

FIG. 3. Pairs of ions per gram air in small graphite chamber.

PART I

The dose in pairs of ions for 50 per cent inactivation in the first series of experiments is 3.56×10^{14} per mg. air.

The ratio between the ionization readings of the chamber (20 per cent Mg)* and the graphite chamber is 1.58 for a wave length of 0.2 A.

Thus the graphite chamber readings would have been 2.25×10^{14} pairs of ions probably for all the experiments of Part I.

Northrop and Clark[1] give as a result of their best considered experiment 2.8×10^{14} pairs of ions per gram of air measured by a large ionization chamber.

The ratio 2.8:2.25 = 1.24, therefore, should be the true ratio between the readings of a large air chamber and the small graphite chamber, if the effect of the different hard rays used by me and the comparatively soft rays (from absorption in paraffin 0.5 A) used by Northrop and Clark is the same.

PART II

The results of the experiments in Part II of this study can be noted in Table II, in which the dose for each experiment is calculated in terms of the number of pairs of ions per gram of air within the graphite chamber.

For each wave length the average 50 per cent dose is graphically (Fig. 3) extrapolated and multiplied by the ratio of the air chamber to the graphite chamber which has been communicated to the author by Dr. H. Fricke of the Cleveland Clinic.

The doses are thus calculated:

$\lambda_{eff} = 0.23$	2.98×10^{17} pairs of ions
$\lambda_{eff} = 0.58$	2.99×10^{17} pairs of ions
$\lambda_{eff} = 0.72$	2.67×10^{17} pairs of ions

The dose is determined with an error of the order of 5 per cent. This corresponds to a 1 per cent error in the determination of the trypsin, when the inactivation is about 20 per cent (from 100 per cent down to 80 per cent). The analyses have an error of the order of 1.5 per cent. Those with an error of 2.5 per cent (1 + 1.5) give the limits within which the true effect of the 75 per cent dose lies. A 2.5 per cent error in a 25 per cent inactivation means 10 per cent on the dose.

The 50 per cent dose was found to be 10 per cent less for the soft rays of $\lambda = 0.72$, but as the deviation from the mean 2.90 is much less than 10 per cent, the experiments do not settle the reality of the difference.

According to Table II, the dose measured with the small graphite chamber is the same for the three kinds of rays, within 4.2 per cent.

The number of ions produced per gram of the solution ought to be between the number produced in the air chamber and that of those in the graphite chamber, as the effective number of electrons per atom of the solution is 7.47, for air 7.67, and for the graphite chamber between 6 and 7.67.

Thus we conclude that if there is a difference between the inactivation effects of soft rays and hard rays per ion in 1 gram of the solution, this does not amount to 10 per cent.

Further experiments with inactivation of trypsin in 0.04 per cent solution buffered in exactly the same way but kept at 2°C. for forty-eight hours and more showed that old solutions are less sensitive to roentgen rays, and that the sensitivity continuously decreases with the age. This hardening effect of age on trypsin solutions is present even if no heat inactivation takes place.

A special experiment with heat inactivation at +34°C. brought out the result that the sensitivity to heat also continuously decreases. For a solution forty-eight hours old the sensitivity both for heat and for roentgen rays was 72 per cent of the sensitivity of fresh solutions. As there may be an error of as much as several per cent in the measurements in both cases, the identity of the ratio does not permit us to use the figures secured in these experiments for the determination of the true dose. Only fresh solutions have been used for this purpose.

* The effective atomic number of the wall material of a small chamber, the walls of which consist of Mg and C atoms arranged in a pattern, where the Mg atoms cover 20 per cent of the surface, should be 7.67. According to the measurements of Fricke and Glasser we would expect such a chamber to give the same readings for the ionization dose as the air chamber. The saturation current should be 16 per cent of the current in a small Mg chamber and 84 per cent of the current in a small C chamber of 3½ c.c. capacity. We observe that 16 per cent of surface does not correspond to 16 per cent of the saturation current (compare 7).

SUMMARY

The inactivation effect of roentgen rays of different degrees of hardness has been determined for equal doses, the doses being measured with the small graphite ionization chamber.

TABLE I

Rad. Fig.	Transformer	Tension, Kv.	Current, Ma.	Filter	Eff. Wave Length	Focal Distance, Cm.	Relative Intensity
B	200 kv. disk rectif.	160	6	0.37 mm. copper 0.9 mm. paraff. gr./cm.^{2}	0.23 Å	24	1/8
F	100 kv.	50	10	0.074 silver	0.58 Å	12	1/6
E	100 kv.	41	20	0.059 molybdenum	0.72 Å	15	1/6

The inactivation by means of roentgen rays is determined to be an exponential function of the ionization dose for buffered solutions of Fairchild's powdered trypsin, pH 5.42.

The amount of inactivation in fresh solutions is independent of the wave length within the limits of error (less than 10 per cent) $0.72\ Å > \lambda_{eff} > 0.23\ Å$.

The sensitivity both for heat and rays is 40 per cent higher in fresh 0.04 per cent solutions of Fairchild's powdered trypsin.

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TABLE II

THE DOSE IN $\frac{\text{HOURS OF EXPOSURE OF THE SAMPLE}}{\text{SECONDS DISCHARGE TIME OF THE ELECTROSCOPE}}$ IS CORRECTED FOR THE SLIGHT DIFFERENCE IN DISTANCE BETWEEN THE ANTICATHODE SAMPLES AND THE ANTICATHODE CHAMBER AND ALSO FOR ABSORPTION WITHIN THE SAMPLE

Kind of Radiation	λ Eff. Å.	Sample No.	Dose, Hours of Expos. / Second Disch.	Correction Factor for Graphite Chamber	Capacity of the Electroscope, Cm.	Real Dose × 10^{-12} in Number of Ions per Gm. Air: Graphite Chamber	Real Dose × 10^{-12} in Number of Ions per Gm. Air: Air Chamber	Rest of Trypsin: Per Cent	Rest of Trypsin: Log Per Cent
C	0.25	1	0.143	0.633	2760	11.3 × 0.091	.....	79.0	0.90
		2	0.282		2760	11.3 × 0.178	.....	53.0	0.72
D	0.45	1–4	0.115	.....	2760	11.3 × 0.073	.....	74.0	0.88
A	0.18	1–2	0.095	.....	2760	11.3 × 0.060	.....	89.0	0.95
A	0.18	3–4	0.165	.....	2760	11.3 × 0.104	.....	69.0	0.84
D	0.45	1–2	0.130	.....	2760	11.3 × 0.082	.....	74.0	0.87
		3–4	0.290	.....	2760	11.3 × 0.183	.....	54.0	0.73
		5–6	0.260	.....	2760	11.3 × 0.165	.....	62.0	0.79
			0.33	.....	.....	.....	1.24 × 2.36 = 2.93	50.0	0.70
C/E	.....	1	3.6 / 28.5	1.00	525	2.15 × 0.126 = 272	.....	89.5	0.952
	0.72	2	6.5 / 28.5	.....	525	2.15 × 0.228 = 491	.....	85.8	0.934
	.....	3	8.8 / 28.5	.....	525	2.15 × 0.308 = 669	.....	81.6	0.912
							1.20 × 2.22 = 2.67	50.0	
F	.....	1	2.5 / 27.5	.....	525	2.15 × 0.091 = 195	.....	95.0	0.98
	0.58	2	9.6 / 20.2 ± 1.0	.....	525	2.15 × 0.475 = 102	.....	72.0	0.86
	0.58	1	9.1 / 20.2	.....	525	2.15 × 0.450 = 97	.....	76.0	0.881
							1.20 × 2.32 = 2.99	50.0	
B	0.23	1	5.75/167	.....	2760	11.3 × 0.0345 = 39	.....	91.2	0.960
		2	5.75/167	.....	2760	11.3 × 0.0345 = 39	.....	90.6	0.957
		3	8.0 /167	.....	2760	11.3 × 0.0480 = 542	.....	81.0	0.908
		4	8.0 /167	.....	2760	11.3 × 0.0480 = 542	.....	83.5	0.922
		5	14.75/167	.....	2760	11.3 × 0.0883 = 1000	.....	75.5	0.878
							1.25 × 2.37 = 2.98	50.0	
C/G	0.70	48 hours old							
		1	7.45/14.4	1.00	525	2.15 × 0.517	.....	77.0	0.887
		2	7.45/14.4	.....	525	2.15 × 0.517	.....	79.0	0.898
							1.20 × 3.06 = 3.67	50.0	

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ROENTGENOLOGICAL ASPECT OF INTUSSUSCEPTION*

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INTUSSUSCEPTION consists of the invagination of one portion of the intestine into another. It frequently culminates in obstruction and occurs in 30 per cent of all cases of ileus. It occurs most commonly in infancy, about 68 to 70 per cent occurring in the first year of life.[1] While it is more frequent in children, it is not uncommon in adults, as was evidenced by Eliot and Corscaden[2] who have collected 300 cases in adults. Their oldest case was a woman, aged eighty-four. Edington[3] reports a case in a man of seventy years. Men are more often affected than women. Intussusception may occur in any portion of the gastrointestinal tract, but the ileocecal and colic or combination of these are most frequent.

Fig. 1. Mechanism of intussusception. (Treves.) (From Holt.)

Causes. Invagination is due to an active tetanic contraction of a circumscribed portion of the intestine, the bowel below the constriction being drawn up over it by the longitudinal muscle fibers (Fig. 1). The intussusception increases at the expense of the normal bowel below. For an intussusception to occur the mesentery must be long. Invagination does not necessarily produce complete obstruction, but as traction on the mesentery increases, the circulation is cut off and congestion, edema and often gangrene are produced. A retrograde intussusception occasionally occurs. In infancy the exciting cause is seldom discovered, but in older children and adults, ulceration, Meckel's diverticulum, benign and malignant tumors and occasionally trauma, heavy lifting and excessive purgation may be causes. Cecum mobile, developmental defects of the cecum and long mesocolons favor the formation of invaginations which are frequently inspired by the presence of small tumors such as are described by Watts[5] (Figs. 2 and 3) and Biggs.[6] Treves[4] states that polypus occurs in about 5 per cent of cases due to tumor. About one-fifth of the cases with tumor are caused by benign tumors and one-seventh by malignant growths.

Of the 300 cases reported by Eliot and Corscaden, there were 60 instances of benign tumor and 40 of malignant tumor. The tumors were usually located at the apex of the intussusception. The benign tumors seemed to be more common in the small intestine and the malignant ones in the large intestine. Foreign bodies rarely cause intussusception.

Martzloff[7] reports in detail a case operated upon by Cullen in which a very early invagination was found in the cecum, which he thinks is an incipient form of cecal invagination which represents one of the stages of more advanced forms of cecal intussusception (Fig. 4). From the pathological evidence at hand he believes

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that an unusual contraction of the wall of the cecum in this particular segment provided the beginning for a series of events resulting in the invagination described. The reverse of Martzloff's suggestion is not improbable, that the changes noted in the cecum may be the result of recurring intussusception. Lorenz[5] and Delore and

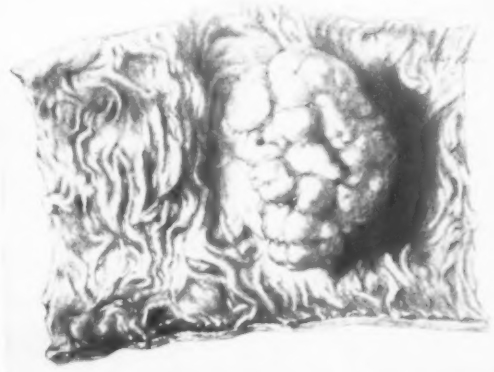

Fig. 2. Section of large intestine with adenoma. (From Watts.)

Leriche[9] also state that lesions in the cecum are frequently the exciting causes of intussusception.

Symptomatology. In acute cases the onset is sudden and the symptoms are so uniform that once having seen a case of acute intussusception in an infant one would scarcely overlook it a second time. But in older children and adults the clinical

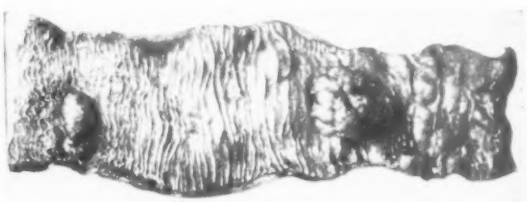

Fig. 3. Section of small intestine showing tumors. (From Watts.)

picture is often misleading. In acute intussusception the onset is sudden with severe abdominal pain of a cramp-like colicky nature occurring paroxysmally every few minutes. Vomiting and diarrhea and occasional bloody stools appear. The abdomen is at first relaxed but during a paroxysm a doughy tumor can often be palpated, which may disappear after the paroxysm subsides and often changes position. The condition rapidly becomes grave and demands immediate operation. Th symptoms in subacute and chronic cases come on more gradually and are less severe. There is usually a history of constipation and attacks of cramp-like colicky pain in the abdomen at regular

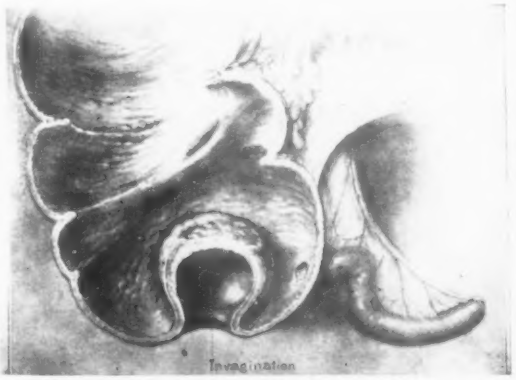

Fig. 4. Schematic drawing of cecum in coronal section showing relation of invaginated portion to orifice of vermiform appendix and ileocecal valve. (From Martzloff.)

intervals, which at first may be relieved temporarily by simple remedies and enemas, but finally terminate in symptoms of impending obstruction. The histories in some instances date back for months or years. In all the different forms of intussusception the presence of an abdominal tumor, which varies in size, shape, position and consistency after a colicky pain renders the diagnosis certain. The absence of abdominal rigidity is customary. The temporary reduction of an intussusception by enema should not postpone operation as a rule.

A chronic case came under our observation in January, 1925, for roentgen-ray examination, which we feel is of sufficient interest to warrant a detailed report. A review of the literature that has some bearing from a roentgenological point of view may also be of interest.

C. W., a white boy six years old, Jan. 22, 1925, was referred by Dr. R. C. Metzel for a roentgen-ray examination of the gastrointestinal tract. He was poorly nourished, and small for his age. He had partial paralysis of both lower extremities, the result of infantile paralysis, but was able to walk. His present

illness began two weeks before this examination with pain in the abdomen. The attacks came on suddenly and doubled him up. He would lie down and draw up his legs until the paroxysm subsided. His appetite was poor. His bowels moved daily. There was no vomiting, no blood in the stools, and no fever. His general condition was fair.

Physical examination during a paroxysm revealed a movable tumor the size of an egg in the upper right quadrant. This tumor a day later had moved across to the left upper quadrant, but disappeared when the paroxysm subsided.

FIG. 5. Twenty-four hours after ingested meal, prone, with diagrammatic tracing showing the intussusception of the cecal tumor, which produces a filling defect at the splenic flexure. Note position of the ileocecal valve which explains why there is not complete obstruction. —— Indicates the intussusceptiens; ---- indicates the intussusceptum.

FIG. 6. Five and thirty hours after ingested meal. Prone. Showing gastric residue. Cylindrical filling defect in transverse colon. Compare with Figure 5.

Roentgen Examination. Twenty-four hours after the ingestion of a barium meal, the head of the barium column had reached the rectum. The small intestine was empty except for a trace in the ileum which appeared to enter the cecum posteriorly. What was thought to be the cecum was situated high on the right side and gave the impression of not having descended in development to the right iliac fossa. The hepatic flexure and transverse colon had an unusually broad lumen and presented a broad central cylindrical filling defect extending across to the splenic flexure where there was practically no barium. The descending colon and sigmoid were redundant, the rectum normal (Fig. 5).

A second meal by mouth at this time revealed a normal stomach situated high; active peristalsis; patent pylorus, and flattened duodenal cap. Observations at one-half and one hour intervals showed the stomach to be emptying slowly. Five hours later, there was 15 per cent gastric residue. The rest of the meal was scattered throughout the small intestine. The terminal loops of the ileum were coiled in the right iliac fossa and entered the colon posteriorly, high on the right side. The central filling defect was still present in the transverse colon, and during a paroxysm of pain a tumor could be palpated near the splenic flexure (Fig. 6).

A cleansing enema was ordered at home and on the following day the child returned for roentgen examination by barium enema (Fig. 7). None of the barium from the previous meals was present at this time. The barium enema flowed freely and filled the colon rapidly; the filling defect in the transverse portion had disappeared (which is explained by a partial release of the invaginated intestine)

and the lumen of the colon was narrower. As the enema reached the ascending colon it rounded out into what was thought to be the cecum. The caput showed a concavity continuous with a filling defect in the cecum about the size of an egg. The ileocecal valve was competent, which is not the case ordinarily in young children.

Analysis of Roentgen Findings. Ingested meal reached the rectum in twenty-four hours. No obstruction was observed. There was a marked increase in the caliber of the colon. The cecum and ileocecal valve were not in their usual position, and there was a central filling defect in the transverse colon which is characteristic of intussusception.

FIG. 7. Roentgenogram taken in recumbent position after enema. Note partial reduction of intussusception. Filling defect in cecum due to tumor.

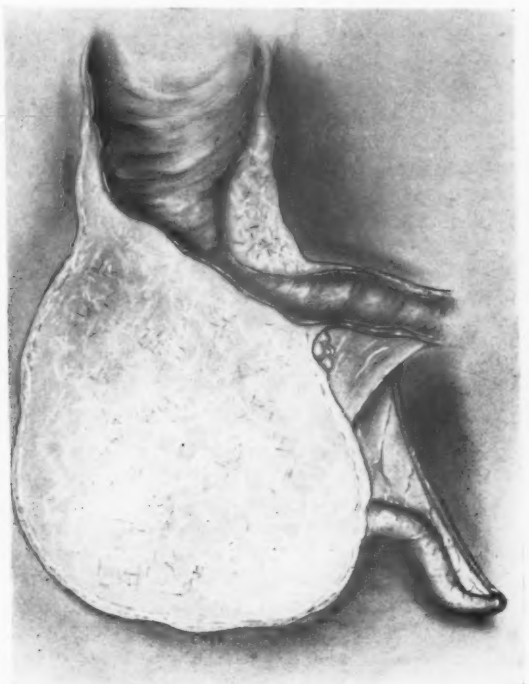

FIG. 8. Artist's drawing of tumor of cecum which was resected by Dr. A. M. Shipley of Baltimore.

Opaque Enema. It is not at all unusual for an invagination, which is loose, to be reduced by an enema, as was noted after the colonic examination, which showed a high, blunt "cecum," with a concave caput and a U-shaped central filling defect; also a competent ileocecal valve, all typical of intussusception.

The child was operated upon a month later, during which period his condition was stationary until just before the operation the mass appeared near the sigmoid.

Operation Feb. 28, 1925. On opening the abdomen the surgeon noted a large mass in the sigmoid. The gut was very large and the mass had a free range of movement up and down in the gut. It was believed that the condition was due to a large polypus, and a longitudinal incision was made over the sigmoid and the mass. When the gut was opened, the mass was found to be a chronic intussusception, which was not strangulated because of the large caliber of the colon. The child's condition was not good. The intussusception could not be completely reduced, so the opening in the sigmoid was closed and a lateral anastomosis was done between the ileum and sigmoid below the intussusception. Murphy's button was used. Two drains were placed in the pelvis and the abdomen was closed.

On March 21, 1925, a second operation was done. The cecum was resected. Murphy's button was used again and the tumor mass was removed (Fig. 8). The condition of the patient after operation was good.

Discharge note on May 13, 1925, stated that the patient was improved.

Pathologist's Report. April 8, 1925. Specimen 13131 was examined. Sections of a mass from the wall of the gut showed replacement

of all normal structures by mononuclear cells. The cells showed fairly large nuclei, many of which were hyperchromatic. Some had mitotic figures. These cells were of one type and were held in a delicate stroma. The blood vessels were poorly formed. Diagnosis: Lymphosarcoma.

A subsequent note, in November, 1926, stated that the child had completely recovered and was in excellent health.

Note from Dr. Hugh Spencer, Nov., 1926. "In reviewing the histologic sections of specimen 13131, I find that there can be no doubt as to the original diagnosis of lymphosarcoma. The type of cell, the reticulum and definite invasive character of the process leave no room for doubt. The growth has had its origin in the submucous lymphoid tissue. In areas it is covered by an intact mucosa; elsewhere that structure is necrotic and has sloughed. Infiltrating lymphoid cells are found throughout the submucous and muscular layers."

Ewing's[25] description of lymphosarcoma of the intestines is of interest in this connection. He states in part that lymphosarcoma of the intestine is an important type of the disease.

"While it is usually found in the ileum, it may appear at any point from the duodenum to the anus. The earliest stage appears as a localized thickening of the submucosa without ulceration. The process extends laterally and invades and destroys the muscular layers, and appears as a subserous tumor which soon forms adhesions. Thereafter, central ulceration excavates the tissue or produces aneurysmal dilatation, which with peripheral growth yields a large tumor with roomy cavity. Large polypoid growths protruding into the widened lumen without ulceration are also observed. Rarely marked stenosis results and perforation may occur. Metastases appear early in regional nodes, and they may extend to many organs. The disease often occurs in childhood, as well as at other ages, and usually runs a rapid course, terminating fatally in a few weeks or months. Acute cases resemble appendicitis. The structure of the growth is that of small or large round-cell lympho-sarcoma. The cells are large or medium mononuclears with liberal cytoplasm lying irregularly in a network of fine fibrils. Fragile blood vessels and many small lymphocytes may accompany the tumor cells. It is especially this group of cases that may resemble an infectious granuloma."

In reviewing the literature on intussusception since 1913, one is impressed by the relative frequency of case reports in which a roentgen examination has been made, as compared with the limited number of references and illustrations in textbooks. There is a certain uniformity in the description of the findings. Most of the authors agree that when the surgeon sees an acute case, the symptoms are more or less clear-cut, and the diagnosis of impending obstruction is plain, so that a roentgen-ray examination is looked upon as an unnecessary delay to the operation which is of paramount importance. But in the subacute and chronic cases there is usually an element of doubt in the mind of the surgeon before he opens the abdomen as to the exact location and cause of the symptoms. It is in such cases that the roentgen examination is of great assistance. Chronologically the following references are found in the literature relative to the roentgenological findings in insussusception.

Ladd[10] reported several cases in 1913 which were examined by Dr. A. George, of Boston, and published roentgenograms of several, showing for comparison the normal colon and one of infantile diarrhea. He thinks that the roentgen-ray facilitated the early diagnosis and helped to cut down the mortality. He suggests the use of the opaque enema to reduce the invagination so that operation may be easier.

Carman[11] reported no cases of his own and published no illustrations. He refers to 2 cases from the literature in which a roentgen examination was made. One case reported by Lehmann[12] was that of an eighteen-year-old patient. The enema was introduced and flowed without interruption to about the middle of the transverse colon. Here it was definitely obstructed, and after a little, the stream sent out a projection about 1 cm. broad along the upper and lower borders of the transverse colon beyond the obstruction, and between these projections was an area of lessened density occupied by the invaginated small bowel. The invagination corresponded exactly to the roentgen findings. The other case recorded by Groedel,[13] was of a boy seven years of age. With the enema the colon was visualized throughout, and there was a slight retrograde filling of the ileum,

but nothing distinctive was seen. Two days later an opaque meal was given. Eight hours afterwards some of it had passed into the colon, but the terminal ileum was markedly dilated, and Groedel considered the picture typical of ileocecal stenosis. At operation 15 cm. of the bowel was found to be invaginated.

Snow[14] reported in 1915 two acute cases in which roentgenoscopy of the colon enema located the invagination. No description of the findings was given.

Altschul,[15] whose case, like that of Groedel, failed to reveal any characteristic findings when examined by the opaque enema, showed when examined by the ingested meal an ileocecal invagination. There is so great a similarity (except for the age of the patient) to our case that the report is quoted in full.

A woman, aged sixty-one, was sent to the author for roentgen examination with the diagnosis of abdominal tumor. For about three years there had been pains in the abdomen, which increased during the preceding three months. Pains radiated from the stomach to the ileocecal region, increased when the patient was sitting or lying down, and decreased when she walked. The stool was ribbon-like, and its evacuation laborious, with pains in the ileocecal region. Recently, purgatives had been necessary. She was without appetite and emaciated, and also had had hiccough for the preceding two weeks. Her abdomen was slightly distended when she entered the hospital. A long, oval, movable tumor of 10 cm. length was palpated from the upper right to the lower left ileocecal region. Apparently it was a chronic intestinal stenosis which had not closed, as is mostly found in cases of carcinoma of the large intestines. The clinical findings did not suggest invagination, although the symptoms described above were perfectly in accord with it.

Roentgen-ray examination gave the following result: A barium enema went up to the cecum inclusively without obstacle, and showed no pathological condition. A second examination with contrast meal was made two days later. The tumor which had formerly been located in the ileocecal region had become larger and had moved higher up, so that it was now located two fingerbreadths to the right and below the umbilicus. Twelve hours after the meal had been taken, the following was found. All of the colon up into the descending portion was filled. The lowest loops of the ileum were dilated and filled. But they were lying where the cecum should have been, and the cecum could not be distinguished in the picture. A rather broad, cleft shadow was found where the ascending and transverse colons begin. This shadow was separated from the shadow of the ileum loops by a small strip which was not filled. The broad shadow showed no haustral markings. The shadow stopped about a hand's width from the region of the hepatic flexure, like a blind pouch with a conically shaped point. It was bordered by gas filled loops, the outer outlines of which bore distinct marks of haustra. The blind pouch-like end was separated from the neighboring shadow of the other part of the transverse colon, which seemed normal, by a light semicircular strip. The outline of the part filled with gas, however, seemed to be like that of a normally filled colon.

It seemed to be a process of stenosis at the ileocecal valve, which was shown by the dilatation of the lowest loops of the ileum and the absence of the cecal shadow. On account of the lack of haustral outlines of the proximal filled colon and the continuation of the latter with the haustral lines of the gas distended parts, the author considered the shadow in the beginning of the transverse colon an invagination of the small intestine.

The roentgen diagnosis was stenosis at the ileocecal valve, and ileocecal invagination was suspected. The author made the diagnosis of ileocecal invagination as only suspected, since the examination with contrast meal enema had been negative and no similar pictures had been described in the literature.

Operation confirmed the suspicion. The lowest part of the ileum was invaginated in the cecum, which barely reached the hepatic flexure. The invagination did not extend as far as the roentgenogram indicated, because the tumor had again decreased and descended on the day of the operation. In the mesocolon two infiltrated glands almost the size of pigeons' eggs were found. The lowest part of the ileum, the cecum and ascending colon were resected and an ileotransversotomy was performed.

The postoperative course was without disturbances.

Another roentgen examination was made a month after operation. The abdomen was slightly distended, a barium meal passed through the anastomosis without the slightest trouble. Histological examination revealed a malignant tumor of the sarcoma type with metastases in the neighboring lymph nodes. It was composed of roundish cells of medium

size with a pale, relatively large, roundish nucleus, and rather broad protoplasm. A distinct reticulum was noticed at several places between the cells, in which smaller cells of the lymphocytic type were found beside the other cell formations mentioned above. The tumor started from the submucosa exclusively and infiltrated the other layers of the intestinal wall. It was apparently an adeniform lymphosarcoma.

According to the same author, there are three types of invagination:

(1) Temporary invagination.
(2) Constant but loose invagination.
(3) Constant firm invagination.

The second type, to which his case belongs, is the only suitable type for roentgen diagnosis.

George and Leonard[16] report a small intraintestinal growth at the base of the cecum, with an intussusception of the cecum, but do not describe the deformity and lay no stress on the intussusception. Their case is illustrated by a color sketch and roentgenogram. The type of tumor is not mentioned.

Walls,[17] in 1918, reported a case of a two-year-old boy with acute intussusception, with the roentgen findings which he describes in general as follows:

> If a barium or bismuth enema were observed under the screen, in a case of intussusception the mass would be seen filling up the bowel until it was arrested by the intussusception, and a small amount of the mass would pass for a longer or shorter distance between the intussusceptum and the intussusceptiens. The shadow made by the thin layer would be so appreciably different from that made by the dense mass that the end of the column would appear to be concave or U-shaped. Such an observation would not occur in any other condition of the bowel, and this sign is presented as of value in the diagnosis of intussusception.

Strauss,[18] writing on intussusception in 1920, gave some points on the technique and interpretation. The roentgenoscopic examination he considers of great importance in all suspected cases of intussusception. It makes an immediate diagnosis possible and also shows in what part of the abdomen the intussusception is.

In giving bismuth enemas, a small rubber catheter is used instead of the regular rectal tube. The small catheter prevents straining and tenesmus. The enema can is held up just high enough to allow the fluid to flow slowly along the colon up to the point of obstruction. When the point of obstruction is reached, gentle pressure upon the abdomen is made to try to force the enema farther along the colon. By doing this we get a typical concave shadow. If no intussusception is present, the enema will flow along the colon and will also pass through the ileocecal valve, for it is incompetent in practically 99 per cent of normal children. It not only gives a means of diagnosing the intussusception in the colon, but it also gives an immediate diagnosis of intussusception in the lowest portion of the ileum.

Kloiber[19] advocates roentgen examination in ileus. He reports 100 cases without contrast meals. In 1921 he made roentgen examinations in cases of ileus without contrast meals by comparing the fluid levels and by the presence of gas areas immediately above the fluid levels. He used this method in diagnosis of ileus due to strangulations, adhesions, carcinoma, hernia, invaginations, tuberculous, carcinomatous and syphilitic.

Czepa[20] reports the following case: a woman, aged forty, had an ileocecal invagination. Post-mortem examination showed nothing unusual. He refers to two other cases reported by Haenisch and Kreuzfuchs.

Kerley and LeWald[21] state that no other condition can produce the typical U-shaped filling defect which is present in intussusception. They publish the only illustration I have been able to find in a textbook (Fig. 9).

> A male child, age 16 months, on the day of illness awoke apparently normal, but later refused his regular feedings. Castor oil and an enema were administered with unsatisfactory results. He vomited during the following night. There was no rise in temperature; no palpable mass; and no point of tenderness. The clinical diagnosis was suspected intussusception.
>
> *Roentgen Examination.* An opaque enema disclosed the site of obstruction and its cause; intussusception of the terminal ileum into the cecum. The injected column of opaque material, when it met the intussuscepted portion of the ileum, spread out over it in a thin layer, leaving the central filling defect in the cecum which could hardly be simulated by any other known condition.

Operation. The abdomen was palpated under anesthesia and no mass was felt. Due to the roentgen diagnosis a small incision was made directly over the cecum. The intussusception was reduced in a very short time and the patient recovered.

The authors' comment was that only a very few cases of roentgen diagnosis of intussusception have been reported. As the roentgen findings are conclusive in a case of this sort, they should not be omitted in a questionable diagnosis.

Gibbon,[22] in giving a review of 11 cases, says: "In two cases where the diagnosis was uncertain because it was not possible to feel a mass at first, roentgenoscopic examination after a barium enema was helpful in arriving at a diagnosis." In cases which are doubtful "my practice has been to administer a barium enema, and study the colon under fluoroscope." Nothing but satisfactory results have been met with in the employment of this agency. In one early case, the patient was not extremely sick, and a mass could not be perfectly made out. The intussusception was demonstrated at the hepatic flexure. At operation the mass was found high up beneath the liver. In another case with only the symptoms of passing blood and mucus by stools, also an early case, roentgenoscopic examination after an enema was helpful in reaching a diagnosis. In a third case presenting all of the typical symptoms without a palpable mass, roentgenoscopic observation showed the colon to be normal. Operation was delayed, the infant kept under observation, it improved rapidly and finally recovered. Of course, if the intussusception is enteric, this method of examination is of no value, but as enteric intussusception accounts for only 30 per cent of the cases, a clear colon on roentgenoscopic examination argues against intussusception in at least 70 per cent of all cases.

Gibbon, in a recent communication, says that we have in the roentgen ray a very definite aid in reaching a diagnosis, particularly through roentgenoscopic examination after a barium enema. We practically always employ this method of diagnosis in conjunction with the history and physical signs unless the case is so frank that the diagnosis is self-evident.

Lafferty,[23] in a personal communication, said that he had examined Dr. Gibbon's cases. He has had only 5 or 6 cases of intussusception, and most of the work on these was roentgenoscopic. He was able on the roentgenoscope to make a roentgenogram which showed the curvature of the bowel contour, and also with the roentgenoscope to see the antiperistaltic waves. In one other case the intussusception was clearly seen to disappear during the examination and the case recovered without further trouble.

FIG. 9. LeWald's case from Volume III, Annals of Roentgenology. The only illustration of its kind that I have been able to find.

Louis and Moorhead[24] report an interesting case of "Double Intussusception of the Upper Jejunum," caused by a tumor, the character of which is not stated Roentgen findings were indicative of obstruction, but did not define the intussusception.

Abt[26] advocates the use of barium enema in acute cases only when necessary, but recognizes its usefulness. He does not think the meal by mouth should be used in acute cases. As a means of attempted reduction, opaque enema under the roentgenoscope is the most logical.

Rankin[27] states that the use of the roentgen ray in acute cases is unnecessary and not to be advised, but in the chronic or subacute type when the diagnosis is obscure, roentgenography will frequently assist. The findings from the roentgenological examination depend upon the

degree, duration and permeability of the invagination and may be relied upon at least to show the degree of stenosis, if not the underlying invagination.

The roentgen ray has found a new field of usefulness in differentiating chronic intussusception, and while a stenosis is the usual picture it may be possible to make out definitely the intussuscepted bowel where the barium enema filters around the invagination.

COMMENT

The striking thing about the reports mentioned is the uniformity of the findings. With few exceptions the authors are all in accord that roentgen-ray examination by opaque enema is as a rule, the quickest and safest method of locating the point of obstruction in intussusception and frequently visualizes the invagination; that the information gained is of the greatest value, and that its use does not materially delay operation.

Groedel, Altschul, Pozzi and Marsh report instances of intussusception in which the barium enema did not show any abnormality. The two former were able to visualize lesions by the ingested meal, which Pozzi and Marsh evidently were unable to do. This brings up a point emphasized by most surgeons that the reduction of vagina innation by enema should in no way deter one from opening the abdomen when the symptoms are reasonably conclusive.

In chronic intussusception, if the patient's bowels are not completely obstructed, one may make the examination by the ingested meal with reasonable safety. The findings are usually a little different, but equally characteristic. There is not a great difference in the findings in children and adults.

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CYSTOGRAPHY AS AN AID TO THE DIAGNOSIS OF PELVIC LESIONS IN THE FEMALE

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DURING roentgen examinations of the urinary and gastrointestinal tracts, the author noticed various abnormal densities in the soft tissues of the pelvis which were very perplexing. In many instances these densities seemed to affect the contour of the filled or partially filled urinary bladder. This problem prompted the study of utilizing the cystographic method as a diagnostic aid in the determination of pelvic tumors in the female, especially since no definite mention of that method has been found in medical literature.

FIG. 1. Normal bladder.

During the past two years, the writer has made over 300 cystograms of patients with various pelvic disorders. The information derived has been of definite value to the clinician and surgeon. It has led to far greater efficiency in the diagnosis and, in many cases, has been a factor in determining whether or not surgery was to be invoked. The diagnosis of pelvic tumors is in many cases not difficult. However, it is well known among gynecologists that the recognition of fibroids, cysts, or other types of pelvic pathology is at times very difficult, especially in unmarried women, in obese patients, or where careful bimanual examination cannot be made. It is in this latter class of cases that the cystographic method is of great help.

Cystography is a simple and harmless method of examination when properly applied. It should be done only by one experienced in the work and equipped with the proper instruments. The patient experiences no pain or discomfort, except when the bladder is very irritable. However, with proper technique even this condition may be easily overcome.

PATHOLOGY

A careful history must be taken and correlated with the roentgen findings. Constant and persistent pressure defects on the partially filled bladder show certain constant characteristic deformities. This is especially true after the menopause when the possibility of pregnancy is ruled out, for pressure defects on the bladder caused by early pregnancy (before the fetal parts become calcified) often simulate tumors of the uterus. Cysts high up in the pelvis with long pedicles, or tumors of the uterus in retroverted or retroflexed positions may not produce pressure on the bladder, but in these cases cystography helps to map out the mass by the variations of the densities produced by the bladder and the tumor mass. In this series the following conditions produce characteristic pressure on the bladder:

1. Uterine fibroids.
2. Displacement of large and atonic uterus.
3. Cysts.
4. Tumors of the broad ligaments.
5. Adhesions.
6. Malignancy of the uterus, tubes or ovaries.

7. Hydrosalpinx.
8. Pelvic abscess.
9. Pregnancy.
10. Ascites.

der capacity in this series was 348 c.c. The minimum capacity was 125 c.c. and the maximum capacity was over 800 c.c. In the cases where the bladder capacity is

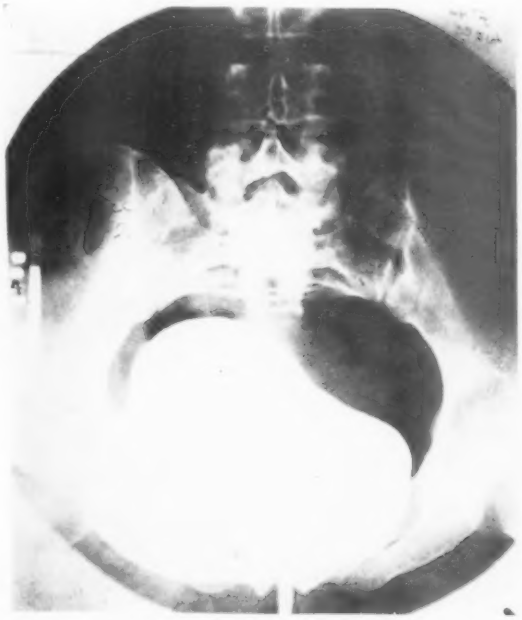

FIG. 2. Atonic bladder.

FIG. 3. Fibroid uterus. This type of pressure is seen in early pregnancy.

FIG. 4. Multiple fibroids of uterus.

FIG. 5. Large fibroid uterus.

The diagnosis in a large number of these cases has been confirmed by operation.

In addition, definite information concerning the size, shape and tonicity of the bladder is thus derived. The average bladder found to be 500 c.c. or more, variable amounts of residual urine are found. The large atonic bladders are usually found in young women during the child-bearing period. Bladder diverticula or ureteral

reflux were not found in any of the cases in this series. In practically all cases of patients with the large atonic bladders, symptoms of urgency are present.

crescentic pressure on the dome of the bladder. Pressure defects caused by ovarian cysts, tumors or lesions in the fallopian tubes and broad ligaments are usually

Fig. 6. Ovarian cyst (left side).

Fig. 7. Dermoid cyst.

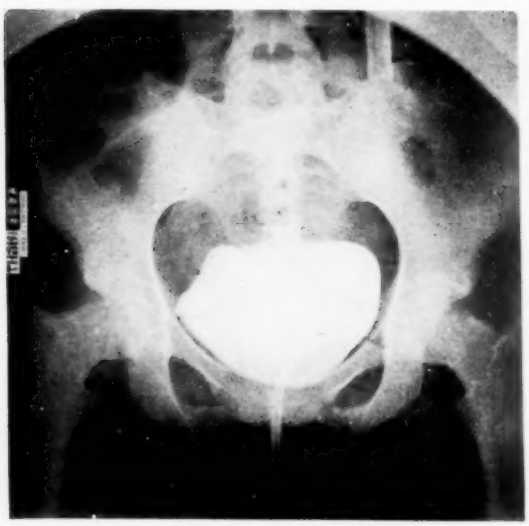

Fig. 8. Pyosalpinx with adhesions.

Fig. 9. Leiomyoma of broad ligament.

INTERPRETATION

The cardinal signs of pelvic tumors are pressure defects, irregularity in contour, and filling defects in the bladder. Uterine tumors and pregnancy produce typical

seen on the lateral wall of the bladder. A straight pressure defect is suggestive of inflammatory changes. In ascites the bladder is quadrilateral in shape. Wavy pressure defects on the upper border of the bladder

are caused by multiple fibroids. Irregularity in contour is usually due to adhesions.

The shape of the bladder varies considerably. The normal bladder shows as a pyramidal or rounded, smoothly outlined organ in the center of the lower pelvis. The hypertonic type of bladder is rounded and small, although sometimes its capacity may reach 400 c.c. The atonic bladder is broad, its base is widened and it has the appearance of an inverted mushroom. The tubular bladder is usually of large capacity.

FIG. 10. Characteristic irregularities caused by adhesions.

FIG. 11. Salpingitis with adhesions.

FIG. 12. Pelvic abscess.

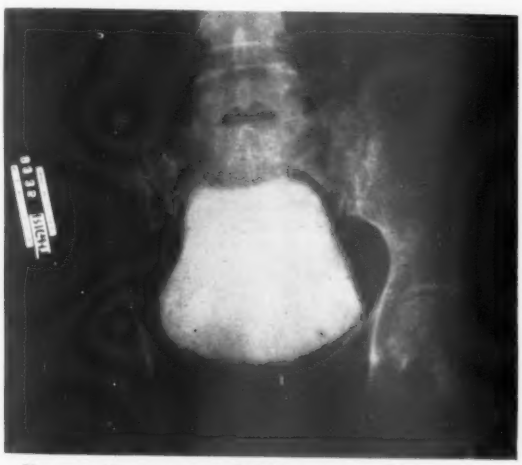

FIG. 13. Pressure on bladder produced by ascites.

TECHNIQUE

1. The patient's bowels must be thoroughly cleaned with catharsis and enema.
2. The bladder should be empty.
3. The examination is made on the roentgen-ray table.

4. The Potter-Bucky diaphragm should be used.

5. A preliminary film is taken to determine the presence of abnormal densities.

6. A sterile No. 14 or No. 16 F. catheter is introduced and the bladder slowly filled with a freshly prepared sterile solution of 3.5 per cent sodium iodide heated to body temperature. The solution is introduced until the patient complains of a slight discomfort. This determines the capacity of the bladder.

7. The gravity method is used with an ordinary 250 c.c. salvarsan cylinder. With the bladder filled and the catheter in place, another film is taken with the tube tilted downward at an angle of 12 degrees. Then the bladder is partially emptied by lowering the cylinder tube and another film is taken. The bladder now contains from 75 to 100 c.c. of the opaque solution. After this the remaining solution is withdrawn and the catheter removed.

8. Films may be taken in the lateral and upright positions. Stereoscopic films may be used for greater refinement of detail. The patients are then advised to drink freely of water so as to flush out the bladder.

The best results have been obtained by using a 3.5 per cent solution of the sodium iodide, as pressure defects behind the bladder may thus be demonstrated. Large pelvic tumors may be overlooked because of counter pressure produced by a completely filled bladder. Pathological changes in the pelvis are therefore best demonstrated with the bladder only partially filled.

SUMMARY

1. Cystography is of definite aid in the diagnosis of pelvic lesions in the female.

2. Cardinal signs are pressure defects and irregularity in contour of the bladder.

3. Pressure on the bladder is diagnostic of a pelvic mass.

4. The type of pressure often determines the nature and anatomical location of the lesion.

5. The best results are obtained by using a 3.5 per cent solution of sodium iodide with the bladder partially filled.

6. It is a harmless and painless procedure.

ABDOMINAL ANEURYSM WITH REPORT OF THREE CASES

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ANEURYSM of the abdominal aorta is comparatively rare. During a period of sixteen years at Johns Hopkins Hospital Osler[1] collected 16 cases out of 18,000 admissions to his wards. Fourteen of these were in men and 2 were in women. Eskuchen[2] over a period of twelve years observed 7 cases in 9,500 autopsies at the Altona Hospital. Shrötter (quoted by Eskuchen) found only 3 cases of abdominal aneurysm among 19,300 necropsies. Abdominal aneurysm is much less frequent than thoracic aneurysm and in Osler's experience the ratio is 1 to 10. This infrequency can be explained by the lessened cardiac impulse reaching the abdominal aorta.

Syphilis is the chief underlying cause of abdominal aneurysm and, excluding trauma, is the all-important factor in patients under the age of forty. In exceedingly rare instances the aorta in abdominal aneurysm has shown no evidence of lues and the only morbid change found in the vessel was simple arteriosclerosis.

The aneurysmal dilatation of the abdominal aorta is usually situated in the upper portion of the abdomen proximal to or in the region of the celiac axis. Here the pressure within the vessel is raised by the sudden alteration in the direction of the flow of the blood stream by the giving off of the celiac axis, the suprarenals, the superior mesenteric, and the inferior

phrenic arteries. Furthermore, the aorta, after emerging from the thorax, loses the supporting tendinous arch of the diaphram. The wall of the vessel at this point is intrinsically weak and often gives way in the injection of the cadaver. The aneurysmal sac usually presents anteriorly and to the left side. This direction is the path of least resistance on account of the rigid spinal column posteriorly and the resistance offered by the liver on the right side.

The symptoms of this disease are quite variable, depending largely on the size of the sac and its location. Small abdominal aneurysms may be so located that they produce no symptoms and are discovered only at necropsy, but are associated with very serious luetic aortitis in the thoracic region. On the other hand, large abdominal aneurysms may produce dull boring pain in the lumbar and sacroiliac regions with agonizing paroxysms of terrific severity. The pain may radiate to the anterior abdomen on the left side and into the groin and testis and along the inside of the thigh to the knee following the distribution of the obturator and genitofemoral nerves. Increase in the intra-abdominal pressure from coughing, sneezing, and straining aggravates the pain. This pain of neuralgic character is usually due to erosion of the vertebrae with pressure on the nerve roots. There may be extensive erosion of the anterior portion of the bodies of the vertebrae, however, without neuralgia, since the nerve exits from the spinal canal are situated farther posteriorly. With extremely advanced bone erosion the lower limbs may be paralyzed from pressure on the spinal cord. There may be nausea, vomiting and abdominal cramps. These gastrointestinal disturbances may be the only early symptoms. They may be intermittent and periodic. Meteorism, vomiting, and belching have been ascribed to anemia in some region of the bowels from fibrin thrombi and to calcification in the vessels narrowing the lumen. It may be true that circulatory and vasomotor disturbances are causative factors in the production of pain. Thrombi breaking off and plugging vessels would explain the sudden attacks. The effect of position and exercise upon the pain may be explained upon the theory of ischemia. Furthermore vagus and sympathetic neuralgia has to be considered in the production of the abdominal pain. Jaundice and enlargement of the liver may occur from pressure on the common bile duct. Vomiting of blood or hemorrhage from the bowels may come from rupture of the aneurysm and leakage of blood into the stomach or duodenum.

Clinically, the most valuable objective finding in abdominal aneurysm is the presence of an expansile pulsating tumor either in the epigastrium or posteriorly in the left upper lumbar region. A bruit may be heard and a thrill felt over the tumor. Diminution of the volume of the crural pulse and its retardation with relation to the radial pulse are signs worthy of mention. The above findings correlated with evidence of widening of the thoracic aorta and insufficiency of the aortic valves in a patient with a history of syphilis make the diagnosis of abdominal aneurysm very probable. The Wassermann reaction is by no means constant.

The mere fact that there is expansile pulsation in an abdominal tumor does not establish beyond doubt the diagnosis of aneurysm. Rapidly growing vascular sarcomas and carcinomas of the pancreas and stomach, or even benign neoplasms overlying the aorta may simulate expansile pulsation. Abnormal throbbing of the aorta is noted in neurotic and hysterical states and must not be mistaken for aneurysm. In aortic insufficiency the pulsation of the aorta may be so forceful as to suggest aneurysm. Preternatural pulsation of the abdominal aorta is also noted in anemia and in arteriosclerosis in old men with thin abdominal walls.

Abdominal aneurysm must be differentiated from tabetic crisis, neuritis, gallstones, pancreatic stones, lead colic, appendicitis, peptic ulcers, gumma of the liver, nephrolithiasis, benign and malignant tumors of the stomach, pancreas, kidney, and omentum. Three of 8 cases of abdominal aneurysm reported by Eskuchen were diagnosed as nephrolithiasis and three times a mistaken diagnosis of sciatica was made. Osler says, "Aneurysm of the

abdominal aorta is very often diagnosed when not present, and when present the symptoms may be so obscure that the nature of the trouble is overlooked."

The roentgen ray may be a distinct aid in the diagnosis of abdominal aneurysm. Rarely can the tumefaction be directly visualized without special effort, but this is possible if there is sufficient calcification in the walls of the sac and vessel. If the aneurysm is located high under the dome of the diaphragm it may be directly outlined by the adjacent air bubble in the stomach and pulsation studied under the roentgenoscope. The aneurysm may be directly visualized with the aid of pneumoperitoneum. Air injected into the colon has been utilized to visualize the aneurysm. Either procedure may show the swelling intimately associated with the aorta or springing from it. The indirect signs of abdominal aneurysm are no less significant than the direct signs. The sharp clear cut areas of destruction in the bodies of the vertebrae are fairly typical of aneurysm. The intervertebral discs remain intact. The preservation of the discs is usually attributed to the resiliency of the cartilage. On the other hand, some observers claim that the bone is absorbed by a chronic inflammatory reaction based on blood supply and the avascular cartilage escapes this process. The intact intervertebral discs serve as a buffer to lessen the impact of the pulsations against the adjacent bone on both sides of the disc. Consequently there is an individual crescent-shaped area of bone destruction in each involved vertebra. Usually more than one vertebra is involved and the spine presents a scalloped appearance (Fig. 3). The region between the twelfth thoracic and third lumbar vertebra inclusive is the site of predilection for the bone changes. Most often the bone destruction occurs along the left anterior aspect of the vertebral bodies. Therefore, semilateral projections of each side of the spine in addition to the standard anteroposterior and lateral views may show the bone changes more clearly. The lower ribs on the left side or the transverse processes of the upper lumbar vertebrae may show rarefaction from pressure absorption. These latter bone changes may occur alone or in conjunction with destruction of the vertebral bodies.

Benign and malignant neoplasms and metastatic retroperitoneal glands may produce absorption of adjacent bony structures and have to be considered in the roentgen diagnosis of abdominal aneurysm. The bone destruction by pressure from neoplasms is usually less marked and fewer vertebrae are involved than in aneurysm. In the writer's experience the only benign tumor observed which produced pressure destruction of the spine destroyed the intervertebral discs also and a massive concavity conforming to the outline of the tumor was hollowed out of bone and cartilage alike (Fig. 4). The question arises whether pressure from neoplasms always destroys cartilage as well as bone. If such is the case then we have a differential diagnostic point. Destruction from aneurysm is apt to be more clear cut and sharply defined. Vertebrae directly invaded by adjacent malignant disease present an irregular, ragged outline with a worm eaten appearance.

The prognosis in abdominal aneurysm is quite grave. The duration of the disease varies from three months to three years. Heroic treatment with iodides and mercury has given some relief of symptoms, but no decrease in the size of the sac has been noted. Death usually comes from rupture of the aneurysm. The symptoms of rupture depend upon the size of the opening and upon its location. Hemorrhages may be intermittent and days intervene between them. But more often, however, when rupture occurs the patient feels something give way and immediately there is terrific pain from peritoneal irritation followed by rapid anemia and collapse. It is not uncommon for the hemorrhage to take place in the retroperitoneal space within the sheath of the psoas muscle, and point below Poupart's ligament.

CASE REPORTS

Case 1. J. S., aged forty-five, colored male laborer, entered Cleveland City Hospital Nov. 23, 1924. The chief complaint was pain in small of back radiating anteriorly to lower left abdomen. The patient began to lose weight one year ago and intermittent pain in the back started six months ago. During the past few

weeks the pain has been constant and more severe. Pain not influenced by position or motion. Had chancre ten years ago.

Physical examination revealed a poorly nourished negro with marked precordial activity with evidence of widening of the aorta. A soft systolic murmur was heard at the base of the heart. A firm tumor mass was felt in the left epigastrium, which showed definite expansile pulsation, not synchronous with the cardiac apex impulse, but immediately following it. Posteriorly just to the left of the spine on a level with the mass a thrust synchronous with that of the mass could be palpated. Blood pressure 140/80, blood Wassermann negative. On the fifteenth day in the hospital the patient suddenly became worse, complaining of choking and inability to breathe. The pulse became progressively weaker without much change in rate. Fullness was noted in the flanks. The patient died in a little over an hour after the sudden onset of these symptoms.

FIG. 1. Direct visualization of abdominal aneurysm in Case 1.

Roentgenoscopic examination showed the cardiac shadow elevated by a mass just beneath the diaphragm. Expansile pulsation could be distinctly made out in this mass made clearly visible by a large gas bubble in the stomach (Fig. 1). Little, if any, widening of the thoracic aorta could be made out. Seven foot films of the heart showed slight general cardiac enlargement. The films of the spine showed erosion of the bodies of the twelfth dorsal and the first and second lumbar vertebrae (Fig. 2). *Roentgen Diagnosis:* Abdominal aneurysm with erosion of adjacent vertebrae.

The necropsy findings pertaining to this report showed luetic mesaortitis with aneurysm in the abdominal aorta which had ruptured in the retroperitoneal region. The peritoneal cavity contained about 200 c.c. of bloody fluid but the great bulk of the hemorrhage was retroperitoneal, pushing the abdominal organs in front of it. The aneurysm measured 7 × 6 × 5 inches. The twelfth dorsal and the first, second, and third lumbar vertebrae showed marked erosion (Fig. 3). This erosion extended almost to the spinal cord. The cartilaginous intervertebral discs were only slightly eroded in contradistinction to the advanced destruction of the vertebrae. The bone destruction occupied the left anterior aspect of the vertebral bodies.

FIG. 2. Case 1. Bone destruction in bodies of vertebrae from abdominal aneurysm (see Fig. 3).

In summarizing Case 1 we find a large abdominal aneurysm in a colored male

laborer who gave a history of having had syphilis. The blood Wassermann was negative. The aneurysm had given symptoms for six months before death resulted from rupture. The aneurysm gave typical

Fig. 3. Case 1. Anatomical specimen showing crescentic areas of bone destruction in the bodies of the vertebrae. The cartilaginous discs are not affected.

clinical and roentgen-ray evidence of its presence. The aneurysm occupied the classical location, slightly to the left and anterior to the upper lumbar and lower dorsal vertebrae. The destruction of the third lumbar vertebra was overlooked in the original roentgen interpretation, but on re-examination of the films it could be made out.

Case II. T. C., white male, aged sixty-two, entered Cleveland City Hospital Feb. 16, 1925.

Fig. 4. Bone destruction from benign tumor in mediastinum, cartilaginous discs destroyed.

The chief complaints were shortness of breath and cough.

One year ago the patient suddenly became short of breath and had a band-like constriction around the chest. He was so dyspneic that he was unable to walk more than a few yards. He entered a hospital and remained there six weeks leaving in fair condition. Since that time he has had shortness of breath and has twice been hospitalized. Has occasionally had swelling of feet. His condition during the past month has gradually become worse until for the past week he has been unable to rest flat in bed. The past history was negative except for sore throat with colds and a penile lesion twenty-five years ago.

Physical examination revealed enlargement of the heart downward and to the left with some widening of the area of aortic dullness, but with no impulse or impact and with no

tracheal tug. Systolic and diastolic murmurs, loudest at the aortic area, were heard. Very feeble pulsation was palpable in both femoral arteries, the liver was enlarged, but there was no edema. Peripheral sclerosis was marked, the pulse corrigan in character. The pupils were irregular and reacted sluggishly. There was definite pulsation in an epigastric tumor.

Roentgenoscopic examination of the chest and abdomen revealed diffuse widening of the ascending and descending portions of the thoracic aorta. There was marked enlargement of the heart, chiefly in the region of the left

FIG. 5. Case 11. Direct visualization of abdominal aneurysm showing calcification in aorta and sac.

ventricle. No tumor mass could be visualized in the abdomen under the roentgenoscope. Anteroposterior and lateral roentgenograms of the lumbodorsal region of the spine showed marked calcification in the aorta throughout its course. The abdominal aorta could be directly visualized by the calcification in it, and at the level of the twelfth thoracic and first lumbar vertebrae an aneurysmal sac with calcification in its walls could be visualized (Fig. 5).

During life pneumoperitoneum was not done on account of the patient's precarious condition but immediately after death gas was injected into the abdominal cavity and roentgenograms were made which show the aneurysm very clearly (Fig. 6).

The autopsy findings of special interest were as follows: Hypertrophy and dilatation of heart; marked simple arteriosclerosis of aorta with dilatation; syphilitic mesaortitis; saccular aneurysm of abdominal aorta. The following description of the aorta is taken from the necropsy protocol: "The aorta is markedly dilated throughout the ascending portion, arch, descending portion and into the proximal

FIG. 6. Same as Figure 5 after pneumoperitoneum.

portions of the larger branches. The organ is markedly decreased in elasticity. The walls are irregularly thickened and in places thinner than the average. The intima is entirely covered by masses of calcification, atheroma formation, atheromatous ulcers, fibrosis and hyalinization. These changes are intermixed and extensive throughout the entire length of the organ. In scattered areas atheroma formation and calcification is less marked and in such areas the intima is thickened, of a light grayish blue color of hyalinization and shows numerous depressed wrinkles either parallel or radiating from a depressed point. In the abdominal aorta, below the diaphragm there is a saccular projection about 7 cm. in diameter. This is situated in the retroperitoneal region to the left of the midline, displacing the stomach upward, the pancreas and the left adrenal downward. The mass is filled with blood clot and opens into the aorta by an orifice 5 cm. in diameter (Fig. 7).

In summarizing Case II we have a moderate sized abdominal aneurysm coincident with luetic aortitis and diffuse dilatation of the thoracic aorta in an individual giving a positive history of syphilis. The patient had no subjective symptoms directly referable to the aneurysm. Symptoms of cardiovascular disease dominated the clinical picture and death came as the result of cardiac failure and exhaustion. The aneurysm gave definite clinical signs of its presence. The abdominal aorta and the sac could be directly outlined in the roentgen-ray negatives by the heavy calcification in the vessel and the sac. There was no pressure destruction of bone by the aneurysm.

FIG. 7. Case II. Anatomical specimen showing size and location of aneurysm in relation to renal arteries.

CASE III. D. S., a colored male laborer, aged forty-two, entered Cleveland City Hospital complaining of pain in the left side extending across the upper abdomen, of six months' duration. There was nausea at times but no vomiting. The nausea came five minutes after eating and lasted one half hour. The appetite was poor and 40 pounds in weight had been lost. Had rheumatism fifteen years ago and was unable to walk for a year. Had repeated gonorrheal infections and had a lesion on the penis two years ago that was self-treated.

Physical examination revealed an emaciated negro male, chronically ill, the skin dry and dehydrated. There was definite peripheral sclerosis of all palpable arteries with definite arcus senilis. The heart was not demonstrably enlarged to percussion but over the anatomical site of the aortic orifice and up toward the right second interspace a tympanitic second sound accompanied by a definite diastolic murmur was heard. A mass in the epigastrium in the midline could be seen and felt. There was systolic pulsation in this mass accompanied by a rather loud systolic blow. Both knee and ankle jerks were absent. The blood pressure was 122/92. The urine showed large quantities of sugar. The Wassermann reaction was 4 plus.

The clinical diagnosis was diabetes mellitus, lues of aorta with early involvement of the aortic area, probably primary ring dilatation, and saccular aneurysm of the abdominal aorta.

Two months after admission to the hospital rupture of the aneurysm was signaled by sudden onset of anemia and death.

Routine roentgen-ray examination of the abdomen and spine showed no evidence of abdominal aneurysm. The diagnosis of abdominal aneurysm was well established clinically and pneumoperitoneum for roentgenography was not done.

The autopsy showed typical luetic mesaortitis throughout the length of the aorta. There was no demonstrable general dilatation of the organ. Just above the orifice of the superior mesenteric artery there was an opening 3×4 cm. in the aorta communicating with an aneurysmal cavity measuring 15 cm. in diameter. The sac was in front and above the kidneys displacing these organs downward

and laterally. The left retroperitoneal region showed recent extravasation of blood which extended downward into the psoas muscle and upward beneath the parietal pleura posteriorly into the mediastinum.

In summarizing Case III we find a large abdominal aneurysm in an individual giving positive signs of syphilis. The aneurysm was diagnosed clinically by its physical signs and symptoms. The routine roentgen-ray examination for aneurysm was negative and emphasizes the fact that abdominal aneurysm may not be demonstrable by roentgen examination without special effort. No doubt the aneurysm could have been visualized had pneumoperitoneum been done and roentgenograms made.

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CHOLECYSTOGRAPHY BY THE ORAL ADMINISTRATION OF SODIUM TETRAIODOPHENOLPHTHALEIN IN SOLUTION

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THE advent of cholecystography has produced a voluminous amount of research that has greatly enriched our knowledge of the anatomy, physiology and pathology of the gall-bladder.

Cholecystograms were at first obtained by the administration of principally two of the halogenated derivatives of phenolphthalein compounds, namely, tetrabromphenolphthalein and tetraiodophenolphthalein. The latter substance is at present used practically exclusively because it possesses certain advantages over the former as indicated below:

Tetraiodophenolphthalein	
atomic weight	127
iodine by weight	61 per cent
Tetrabromphenolphthalein	
atomic weight	80
promine by weight	50 per cent

It is therefore seen that greater resistance to the passage of the rays is offered by the iodine compound, the utilization of which product is also enhanced by its comparative freedom from reaction.

The two methods of choice of administration of the dye are the oral and the intravenous. The other means attempted were rectal injection and introduction of the dye into the jejunum through the duodenal tube, both of which have been generally abandoned because of the unsatisfactory results of the former method and the manifest discomforts accompanying insertion of the duodenal tube.

The first workers to introduce and advocate the oral method were Menees and Robinson in 1925. Since then, much has been accomplished by various investigators in endeavoring to perfect this procedure. While the results have been most encouraging, the various types of pills and capsules favored by different roentgenologists detract from any degree of uniformity. If the dye could be given in some agreeable manner that would preclude the necessity of giving capsules, the oral method would be much simplified. The administration of capsules entails certain objections which

we all encounter. Chief among these is procuring proper absorption of the dye substance. Other factors which should merit consideration are the complaints of many patients of the difficulty they experience in swallowing any kind of capsule or pill, and of many others who are troubled by the distress and fullness incidental to taking a number of capsules with large draughts of water at frequent intervals.

The disodium salt as ordinarily available is a dry powder. It is soluble in water but when stirred, readily forms small masses even though soluble. In the presence of an acid, the free acid of tetraiodophenolphthalein is formed which appears as a white sediment which is highly insoluble in water.

If the sodium salt is taken directly into the stomach in plain gelatin capsules, the acid gastric juice permeates the capsules and converts the salt into the insoluble free acid, a film of which forms around the periphery of the dye which retains the general contour of the capsules and is quite hard in consistency. Upon passing into the duodenum, these capsule-shaped masses of the free acid are not all changed into the soluble salt by the alkaline intestinal juices, only a very small amount of the free acid being converted and available for absorption.

Various means have been adopted to carry the disodium salt unaffected through the acid stomach. The powder has been given in the form of enteric tablets and in capsules hardened to withstand the attack of the gastric juice. Many of these types are now procurable. The writers in a previous publication advocated the use of double capsules, the inner containing the dye and the outer filled with sodium bicarbonate as a protection against the attack of the HCl.

We believe that even if all the capsules administered in every instance pass unmolested into the duodenum, the dye acted upon by the duodenal contents becomes lumpy exactly as in water and not being finely divided cannot be evenly distributed for proper absorption. That this is true is amply manifested by the scattering throughout the intestinal tract of opaque masses of the unabsorbed dye so commonly seen .In this concentrated form, the dye is probably more irritating to the intestinal mucosa. Considering these facts, we thought of preparing the dye in some manner so that it might be evenly distributed for absorption. Experiments with this objective in view were conducted.

Eight ounces of an aqueous solution of the disodium tetraiodophenolphthalein, care being taken to secure a perfect solution, were administered with the intention of removing the gastric contents for examination. It was scarcely necessary to resort to the stomach tube, however, as the individual vomited within twenty minutes after taking the dye and apparently the greater part of the solution was returned. Examination of the vomitus revealed dye in its free acid state. Cholecystograms sixteen hours later resulted surprisingly in quite distinct gall-bladder shadows. This intimated that but a small amount of the dye is necessary to produce shadows and that given in solution even though converted into the free acid a certain amount is available for absorption, because in such a finely divided precipitate it is converted by the alkaline intestinal juices into a soluble salt.

Was the gall-bladder visualized because a very small portion of the solution passed into the duodenum before any acid conversion occurred? Was there any absorption of the dye from the stomach itself? Was the free acid formed immediately after the dye came in contact with the stomach and in its finely divided state, did it pass into the duodenum there to be converted into the soluble salt? The latter inference was drawn and if this proved to be the case, would it not be possible to administer the dye in the form of the free acid which is well tolerated by the stomach.

We prepared aqueous solutions of the free acid which were given to 10 persons and negligible results followed as but one gall-bladder was visualized in this series. The solutions had been made up at one time and given throughout the course of a week and it therefore occurred to us that freshly precipitated free acid might be more easily converted into the soluble

salt than a sediment that had been allowed to stand in solution for any length of time.

It was found that adding fruit juice to the dye precipitates the free acid and of the different brands, grape juice was selected as the most suitable because its pleasing color is but slightly altered by the dye and its taste almost imperceptibly affected, there being scarcely any difference in taste between the pure grape juice and that to which the tetraiodophenolphthalein is added. This mixture can be best prepared for administration by first dissolving the dye, 3 grams, in one ounce of water guarding against any lumping by filtering the solution. To this is added 8 to 10 ounces of a standard grape juice which precipitates the free acid in a very finely divided fresh state. The resulting mixture is most palatable and very well relished. The finely divided free acid is readily converted into the soluble salt by the duodenum and excellent cholecystograms are obtained.

In order to eliminate the time-consuming factor in preparing the dye in this manner and to obviate any difficulties patients might encounter when given the dye to prepare themselves, our next problem was to stabilize the suspension so that it could be put up in individual doses in order that it might be kept indefinitely and yet form when administered a freshly precipitated free acid which is absolutely essential. This was solved by making a watery solution of the disodium salt of tetraiodophenolphthalein to which is added sufficient malic acid to exactly combine with one-half of the sodium present. It is presumed that this treatment breaks up the unstable disodium salt into the stable monosodium salt and sodium malate, thereby preventing decomposition.*

Before administering this suspension, it is necessary to entirely convert the monosodium salt to a freshly precipitated free acid which will pass into the duodenum in a finely divided and active state. This is accomplished by merely adding 8 to 10 ounces of grape juice. The tartaric acid in the grape juice is much more than sufficient to entirely convert the monosodium salt to the free acid.

The advantages of the tetraiodophenolphthalein suspension for oral use may be summarized as follows:

1. The entire dose is taken at one time in a pleasant, palatable form.

2. It is best given very cold and it is well tolerated by the stomach, nausea rarely occurring.

3. Diarrhea is less marked than by the capsule or pill method.

4. The tetraiodophenolphthalein is in the suspension in a finely divided condition and will not deteriorate so long as it is kept in sealed bottles.

5. Upon adding fruit juice, preferably grape juice, a freshly precipitated free acid is formed.

6. The free acid in this state is easily converted into the soluble salt by the alkaline duodenal contents.

7. The free acid when given in the form of a liquid passes quickly into the duodenum because liquids following the so-called "water-way" (lesser curvature) of the stomach have a tendency to leave the stomach rapidly.

*The pharmaceutical division of the National Aniline and Chemical Company, whose close co-operation has made this work possible, are preparing the suspension in individual doses each bottle containing 3 gm. of the dye which uniform dosage we use in all cases regardless of weight of patients.

PNEUMATIC RUPTURE OF THE INTESTINE, WITH ROENTGEN-RAY STUDIES FOLLOWING RECOVERY

CASE REPORT

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RUPTURE of the intestine from the introduction of compressed air into the rectum was first described by Andrews[1] in 1911, and other scattered cases have since been reported in the literature. Schwartz[4] in 1922 reported an interesting case. Especial mention should be made of an exhaustive and carefully written description of this condition in Gant's recent work on "Diseases of the Rectum, Anus and Colon."

FIG. 1. Stomach immediately after the barium meal.

So far as I have been able to make out in a review of the literature, no one has made an after study of the condition of the colon following such an extensive damage, and successful repair and recovery. This paper reports a case of extensive rupture of the sigmoid, cecum and ascending colon with successful repair. It also reports roentgen-ray studies of the colon, which were made five months later.

The advantages of such a study are that it affords an opportunity to observe the behavior of the colon after very extensive changes have taken place in its contour. Following such a repair there is necessarily a great narrowing of the lumen; the muscular coats are doubtless replaced over the injured area by scar tissue, and as a result the contour and activity of the bowel are greatly disturbed. The remarkable features of this case are that the man suffers very little from this condition, and that his bowels function in a manner fairly approaching the normal.

CASE REPORT

The history of this case is as follows: On July 7, 1923, a man came under my care at the Higgins Memorial Hospital in a condition of shock, gasping for breath, and with an enormous distention of the abdomen. The abdomen was tightly distended, globular, and the skin drawn tensely over the distended area, giving the appearance of a toy balloon inflated with gas.

The history of injury was given to me as follows: When the men were cleaning up at the close of the day's work, they were dusting off their clothes with a compressed air hose. The pressure in this hose is 60 to 65 pounds, and it is said to be an effectual method for cleaning off the dust and dirt which accumulate. While this process was going on, one of the men stooped over, and it was noticed that he had a hole in the seat of his trousers. Without thinking about the serious dangers of compressed air, one of the men inserted the nozzle of the hose in this hole. The space between the buttocks then made an excellent valve and the air was driven with great force into the rectum. The man who was responsible for the accident had no idea that he was doing anything wrong or dangerous.

The diagnosis was ruptured bowel from over distention with compressed air.

On opening the abdomen a great quantity of blood was lying free in the pelvis and among the coils of bowel. A large loop of bowel, greatly dis-

tended and looking like a toy balloon, presented in the incision. This was found to be the cecum. The appendix was in its usual position, and was blown up with air so that it was almost round. There were two long tears, one on each side of the cecum, extending from the base of the appendix upward about 7 inches. These tears extended through the peritoneum and muscular coats. The mucosa of the bowel pouted out through the long tears on each side of the colon. Blood vessels along the course of these tears were torn and bleeding freely. The tears were sutured with continuous suture of silk, taking in the muscular and serous coats; above this a Cushing suture to oppose the peritoneal surfaces, and reinforcing mattress sutures of silk. The appendix was removed and the stump inverted.

The sigmoid flexure was next examined. This was badly bruised and bleeding from a number of small tears. There were five of these tears, each one being about 1½ inches long, and extending through the peritoneal and muscular coats. These tears were sutured in a manner similar to the larger tears in the cecum and ascending colon. Abdomen closed in layers. A rectal tube was inserted into the rectum 7 inches and fastened with adhesive plaster.

Recovery was uneventful. Temperature was normal after the fifth day. Wound healed by first intention. Bowels moved with little trouble after the first week. Mineral oil given freely.

A roentgen-ray study of the colon was made five months after the injury. The patient at this time was in excellent health. The stomach behaved normally and filled well. The six-hour examination showed a poor filling of the cecum and ascending colon. The contour of the bowel is irregular and deformed. There are evidently numerous adhesions in the vicinity of the cecum and ascending colon. The sigmoid appears to be normal except for a narrowing in the first portion (Figs. 1, 2 and 3).

FIG. 2. Twenty-four hours after barium meal, showing irregularity in contour of cecum.

FIG. 3. Colon with barium enema.

CONCLUSIONS

Pneumatic rupture of the colon is a catastrophe with which every surgeon should be familiar. Rupture occurs in certain definite portions of the intestine and must be repaired at once in order to save life. In the present case, repair of the bowel is satisfactory and the ultimate result is better than one would anticipate from such a severe traumatism.

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ADVANTAGES OF A ROENTGENOLOGICAL CHEST SURVEY APPLIED TO RECRUITS AND OVERSEAS REPLACEMENTS OF THE UNITED STATES ARMY*

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SINCE the universal use of a roentgenological examination of the chest has come into vogue as a measure in the diagnosis and observation of progress of cases of pulmonary tuberculosis, the idea was conceived that the United States Army could profitably employ this diagnostic aid routinely in the examination of recruits and troops for overseas replacements.

Hereinafter are given the results of an investigation covering the following points: (1) The incidence of pulmonary tuberculosis among troops in the Hawaiian Department for the years 1923, 1924, and 1925; (2) the extent of pulmonary involvement, with reference to the length of service; (3) the number of cases that, by the present methods, were passed as physically fit at the time of enlistment, but which, by roentgenological examination of the lungs, would have been revealed as tuberculous and rejected, and (4) the possible saving to the government if all recruits or overseas replacements were given a routine roentgenological survey of the chest prior to enlistment or embarkation.

The records show a total of 68 cases returned to the mainland for treatment for pulmonary tuberculosis during the years 1923, 1924 and 1925. Of these, 27 returned in 1923, 14 in 1924, and 27 in 1925.

The length of service at the time the disease was discovered is shown in the following chart:

Enlisted service of less than 1 year	19 cases
Enlisted service of less than 2 years	15 cases
Enlisted service of less than 3 years	15 cases
Enlisted service of over 3 years	15 cases
Officers (all over 3 years' service)	4 cases

From the above data it is evident that a high percentage of pulmonary tuberculosis is found during the first three years of service or among recruits. In other words, 80 per cent of all pulmonary tuberculosis occurring during this period in the Hawaiian Department is found in its recruits after they have been enlisted in the service as physically fit.

The question arises as to whether these men developed tuberculosis after their enlistment in the army, or whether they had a tuberculous infection at the time of enlistment, and the existing methods of examination failed to reveal the presence of the disease.

To aid in this determination I have classified these 68 cases as to the extent of involvement of the lungs at the time they were discovered as tuberculous: (1) those showing a minimal involvement in only one lobe, and (2) those showing more extensive involvement, at least two lobes showing definite lesions of the disease.

The following chart shows the extent of the infection with reference to the total

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length of service at the time they were diagnosed as tuberculous:

	Involvement of One Lobe, Cases	Involvement of More than One Lobe, Cases
Enlisted service of less than 1 year	2	17
Enlisted service of less than 2 years	4	11
Enlisted service of less than 3 years	1	14
Enlisted service of more than 3 years	1	14
Officers (all over 3 years' service)	1	3

The high percentage of cases showing involvement of more than one lobe is at once noted, 89 per cent for the total cases and 86 per cent for those cases of the recruit class or in their first enlistment. It is evident to those familiar with pulmonary tuberculosis that the great majority of these cases found in their first enlistment had tuberculosis at the time of enlistment but the disease was not discovered.

I am informed that it costs the government about $1,250.00, on the average, to bring a soldier to this department, ration, clothe, pay him and return him to the mainland for treatment, in cases of this character. This has meant an average outlay of about $28,000.00 a year for all tuberculous cases found in this department during this period and about $6,250.00 for those cases having less than one year's service, in the raw recruit class, manifestly tuberculous at the time of enlistment and not disclosed by the present methods of examination.

From a careful study of these cases it may be accepted that approximately 90 per cent of the cases which arose during the first enlistment would have been demonstrable by a roentgenological survey of the chest at the time of enlistment or embarkation, and either rejected from the service or prevented from going on overseas duty where they always are a greater liability.

The average number of replacements per year in this department is about 4000. The cost of materials to make a roentgenological chest survey on all of these probably would not exceed $1.50 per individual or $6000.00 for all replacements. It is therefore evident that it would cost no more to survey all these replacements prior to their coming on foreign service, and thus keep those unfit on the mainland, than it now costs to return the few with less than one year's service who are found tuberculous; and only one-fifth of the total cost for all those found tuberculous.

As 88 per cent of cases were expectorating active tubercle bacilli the elimination of these prior to their coming on foreign duty would help materially in the prevention of additional infections.

The advantages to be gained from a roentgenological chest survey of all recruits or overseas replacements are several:

1. The gain in efficiency due to the immediate elimination from the army of an appreciable number of individuals who soon become unfit for any duty and are always a liability.

2. The gain in safety due to the immediate removal of a number of open cases who are a constant source of danger. This is especially pertinent when living conditions on transports are considered.

3. The financial gain as stated. I have talked with many clinicians about this procedure and they are universally in agreement as to its value and that it will not only be a success from the standpoint of diagnosis and preventive medicine but also advantageous from a financial standpoint. The only point ever raised is the feasibility of such a procedure.

When considering the feasibility of a roentgenological chest survey as a routine measure, the situation at once separates itself in two parts: (1) the routine examination of recruits prior to their enlistment, and (2) the routine examination of overseas replacements at some time prior to embarkation.

The present method of completion of enlistment of recruits at all isolated locations makes a roentgenological chest survey not practicable as a routine measure. When, however, recruits are collected after enlistment, as they are in most corps areas, this procedure could be carried out, with-

out any administrative delay, while they are in the period of their recruit training and receiving their examinations, inspections and inoculations.

With overseas replacements the plan is feasible. The present method of collection of replacements on both the East and West coasts is such as to make possible a routine roentgen-ray survey of the chest, which can be carried out without delaying embarkation.

The Medical Department personnel at present on duty in the corps area centers and at embarkation points, could, I believe, with slight modification accomplish the additional roentgen-ray examinations.

SUMMARY

1. Within three years 68 cases of pulmonary tuberculosis have been returned to the mainland from the Hawaiian Department, United States Army.

2. Of these, 19 cases, or 28 per cent, had had less than one year's service and 49, or 80 per cent, were first enlistment men with less than three years' service.

3. Of the 49 cases discovered during their first enlistment 42, or 86 per cent, had involvement of more than one lobe of the lungs and 88 per cent had tubercle bacilli demonstrable in their sputum.

4. Ninety per cent of these cases could have been discovered at enlistment or prior to embarkation for overseas duty by a roentgenological chest survey.

5. A roentgenological chest survey of troops, prior to embarkation for overseas replacement, is feasible and can be accomplished without delay.

6. A study of costs will show that it would be economically advantageous to the United States Army to accomplish a routine roentgen-ray chest survey of all recruits and of overseas replacements.

Vol. XVIII, No. 6

THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

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Publishers: PAUL B. HOEBER, INC., NEW YORK

Issued Monthly. Subscription $10.00 per year, $11.00 in Canada and $12.00 in foreign countries. Advertising rates submitted on application. Editorial office, 1909 Massachusetts Ave., N. W., Washington, D.C. Office of publication, 76 Fifth Avenue, New York.

Information of interest to all readers will be found on page ii.

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Publishers: PAUL B. HOEBER, Inc., 76 Fifth Avenue, New York City.

Twenty-ninth Annual Meeting: Kansas City, Mo., 1928. Date to be announced.

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Thirteenth Annual Meeting: Minneapolis, Minn., June 11, 1928.

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EDITORIALS

THE MEDICOLEGAL ASPECTS OF THE PRACTICE OF ROENTGENOLOGY

THE practice of medicine as it exists in civilized countries today is the result of a very gradual development through many centuries of human progress. As society has become more complex, it has become increasingly necessary to control and regulate medical practice in order to prevent exploitation of the public by unqualified practitioners. The last twenty-five years have witnessed a change in the standards for the practice of medicine in the United States that is little less than revolutionary. This has been due in part to incomparably higher educational standards in our medical colleges and the consequent elimination of a great number of low grade colleges, and also to the constant propaganda against quackery and the fearless exposure of all sorts of medical nostrums. Keeping pace with this progress within the profession and due largely to efforts of medical organizations, there has developed a great body of legislation and regulations governing medical practice in the various states. Not only is it necessary to be properly licensed in order to practice medicine but those who are so licensed have certain legal obligations toward their patients, violation of which constitutes malpractice and renders the physician legally liable. It was inevitable that the use of so powerful an agent as the roentgen ray for diagnosis and treatment of disease should be fraught with risk and that injuries should result. It is only too well known that such has been the case and that many suits have resulted because of both real and alleged injuries. It is true that many such suits have been brought upon insufficient grounds and the defendant has often been able to defend them successfully. Even in such cases, however, he is subjected to the annoyance and expense of defending the suit.

Anyone practicing roentgenology or radium therapy may find himself involved in a suit at any time and it is important that all such should be thoroughly familiar with every phase of the medicolegal aspects of the practice of medicine in general, and of roentgenology in particular. We desire, therefore, to call attention to a chapter in the new second edition of "X-Rays and Radium in the Treatment of Diseases of the Skin" by George M. MacKee.* Chapter XLIII of this book deals with "The Medicolegal Relations of Roentgen Therapy and Radium Therapy." Its purpose as stated by the author is "to show the connection between the law and the practice of medicine." The entire chapter is filled with information and advice of great importance to all roentgenologists, but nothing in it is more important than that contained on page 725 concerning the value of well-kept records. The following is an extract from a quotation from an opinion of the Supreme Court of Appeals in which judgment was affirmed for the plaintiff. "There was evidence in the case to the effect that the defendant did not keep an accurate record of the *x*-ray treatment or any record of the exact dose of *x*-rays applied in the several treatments therewith; that if the standard dose only had been applied it was extremely improbable that any bad results would have been caused . . . The cross examination of the defendant tended to show that his memory of the dose applied by him in the several treatments was not to be relied on."

It is certain that poorly kept or insufficient records have often prejudiced the defendant's case in suits against roentgenologists. The record of the case cannot be too full upon all matters pertaining to diagnosis, treatment, and the progress of the disease. It is very important that all

*X-Rays and Radium in the Treatment of Diseases of the Skin. By George M. MacKee, M.D. Second edition, thoroughly revised. Cloth. Price, $10.00. Pp. 788, with 354 engravings and 31 charts. Philadelphia: Lea & Febiger, 1927.

data bearing upon the diagnosis of the condition to be treated be fully recorded. We quote again: "The law considers that one of the fundamental requisites of the medical practitioner who uses the roentgen-rays is the ability to make properly a skilful and careful diagnosis . . . and if the practitioner errs in that diagnosis through lack of proper skill or care, he must answer to the patient for the injury caused by the erroneous diagnosis just the same as he must answer for the application of improper treatment. If by the exercise of proper care and skill a practitioner ought to find out that a person is unusually susceptible to injury by the roentgen-rays and fails to do so, or after making the discovery fails to warn the patient of the danger, the practitioner is liable if he causes the patient injury which otherwise not have happened. And it would be unwise and unsafe to follow the diagnosis of any other practitioner unless one's own careful and skilful diagnosis led to the same opinion or if it differed without a consultation with the other, especially if the patient had been sent by him."

The physician may exercise ever so careful skill and judgment in making his diagnosis, however, and if he has no records which he can produce to prove that he did so he may not be able to establish the fact if suit is brought against him.

After the diagnosis is made and recorded every detail with regard to the treatment must be set down minutely, including all the factors of dosage, the location, size and number of areas treated, the kind and thickness of filter, etc. Upon every subsequent visit of the patient the symptoms and signs of the disease should be recorded, whether or not there is improvement, and especially the condition of the skin in the areas treated.

There is a somewhat general opinion among physicians that a release previously obtained from a patient constitutes adequate defense if suit is brought for injury. Upon this point MacKee makes the following statement: "While the writer has been unable to find a case exactly in point, it is safe to say that there can be no legally binding agreement with a patient not to hold a medical practitioner for negligence; that is, before the negligence occurs."

Another prevalent idea is that any attempted settlement of a suit or threatened suit is a concession of liability. We believe MacKee's statement on page 736 with regard to compromise is correct. It is as follows: "Compromise and settlement before trial is frequently possible and often advantageous in view of newspaper notoriety, loss of time, waiting for trial or final decision because of appeal and effect of possible adverse verdict and judgment. Many have the mistaken notion that settlement concedes liability. If a settlement is sufficiently advantageous it is merely a business proposition. Offers of settlement are not usually permissible in evidence at a trial.

"A contract of settlement is legal, and releases the physician from all further liability. In the cases of infants and incompetent persons the approval of the court will usually be necessary."

The chapter concludes with a thorough discussion of preparation for trial. The importance of painstaking preparation for the trial of a suit is seldom realized by the physician until the trial is actually on and then it may be too late. MacKee emphasizes the importance of the following points: (1) preparation for defense should be begun as soon as notice of claim is received regardless of chances of overtures for settlement; delay is hazardous; (2) no diligence in locating favorable witnesses and evidence should be neglected; (3) all records should be assembled having any bearing on the case, including data on diagnosis, photographic records of condition prior to treatment and records of treatment and results; (4) a complete bill of particulars of the plaintiff's claims of injuries and damages should be obtained by agreement or order of the court; (5) it is usually advantageous to get by consent or order of the court a physical examination of the plaintiff, at which examination expert witnesses can obtain at first hand data of the existing condition; (6) "it is important to have the written medical authorities on the question involved, and to keep in mind any letters, writings or lectures bearing on the disputed points;"

(7) the necessity of assembling competent expert witnesses.

There is much additional valuable information in the chapter which cannot be mentioned here. A review of the entire book will be published in an early issue of the Journal, but it seems of importance to call attention of our readers to the above very timely exposition of a vitally important subject.

CORRECTION

Attention is called to a typographical error on page 328 of the October number of the Journal. In the first paragraph, sixth line, the number 371 should be changed to 37.

Subscribers to THE AMERICAN JOURNAL OF ROENTGENOLOGY & RADIUM THERAPY *visiting New York City are invited to make the office of the publishers (Paul B. Hoeber, Inc., 76 Fifth Avenue, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this column solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. John T. Murphy, 421 Michigan Ave., Toledo, Ohio.
Twenty-ninth annual meeting, Kansas City, Mo., 1928. Date to be announced.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. Fred M. Hodges, 801 West Grace St., Richmond, Va.
Annual meeting, Minneapolis, Minn., June 11–15, 1928.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. Robert J. May, St. Luke's Hospital, Cleveland, Ohio.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. E. C. Samuel, New Orleans, La.

BUFFALO RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St.
Meets second Monday of each month except during the summer months, the place of meeting to be selected by the host.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. R. A. Arens, Michael Reese Hospital
Meets monthly on second Thursday from October to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session at 8 P.M.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. James H. West, 8314 Euclid Ave.
Meetings are held at 6 o'clock at the University Club, on the fourth Monday evening of each month from September to April, inclusive.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. O. J. Shore, 2033 Park Ave.
Meets monthly on second Friday from October to May, at Wayne County Medical Society Building.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. H. C. Kariher, Decatur, Illinois.
Regular meetings held quarterly.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. M. C. Sosman, Peter Bent Brigham Hospital, Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. E. Everett Rowell, 200 West 59th St.
Meets monthly on third Monday, New York Academy of Medicine.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. D. S. Childs, 316 Gurney Bldg., Syracuse, N. Y. Three meetings a year—April, August and November.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. Harold B. Thompson, Seattle, Wash.
Two meetings a year.

ROENTGEN RAY SOCIETY OF CENTRAL PENNSYLVANIA
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. Eugene Pendergrass, University of Pennsylvania, Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. James M. Flynn, 282 Alexander St.
Meets monthly on the first Friday evening at 7.45 at the Rochester Medical Association Building.

ST. LOUIS ROENTGEN CLUB
Secretary-Treasurer, Dr. L. R. Sante, Metropolitan Building.
Meets first week of each month. Time and place of meetings designated by president.

TEXAS RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. C. P. Harris, Houston, Texas.
Annual meeting, Galveston, Texas, 1928.

British Empire

BRITISH RÖNTGEN SOCIETY
Meets on the first Tuesday of each month from November to June inclusive, at 8.15 P.M., at the British Institute of Radiology, 32 Welbeck St., London; W. 1.

BRITISH INSTITUTE OF RADIOLOGY
Secretary, Dr. John Muir, 32 Welbeck St., London, W. 1.
Meets at 32 Welbeck St., but regular dates and times of meeting have not yet been arranged.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets on the third Friday of each month during the winter at 8.30 P.M. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

RADIOLOGICAL SECTION, AUSTRALASIAN MEDICAL CONGRESS
Secretary, Dr. C. A. Anderson, The Hospital, Dunedin.

RADIOLOGICAL SECTION OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

CANADIAN RADIOLOGICAL SOCIETY
Secretary, Dr. E. C. Brooks, Montreal.

RADIOLOGICAL SECTION, NEW ZEALAND BRITISH MEDICAL ASSOCIATION
Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch.
Meets annually.

* Secretaries of societies not here listed are requested to send the necessary information to the editor.

CONTINENTAL EUROPE

BELGIAN SOCIETY OF ROENTGENOLOGY
Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS IN CZECHOSLOVAKIA
Secretary, Dr. Walter Altschul, German University, Prague, 11/52.

DEUTSCHE RÖNTGEN-GESELLSCHAFT (GESELLSCHAFT FÜR RÖNTGENKUNDE UND STRAHLENFORSCHUNG)
Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.
Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.
Next meeting with the Gesellschaft deutscher Naturforscher und Aerzte will be in Hamburg, September, 1928.

SUD- UND WESTDEUTSCHE RÖNTGENGESELLSCHAFT
Meets annually in different cities.

NORD- UND OSTDEUTSCHE RÖNTGENGESELLSCHAFT
Meets annually in different cities.
Next meeting September 27, 1928, in Hamburg.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

SOCIETA ITALIANA RADIOLOGIA MEDICA
Secretary, Professor M. Ponzio, University of Turin, Turin.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs S. A. Reinberg and S. G. Simonson.
Meets annually.
Fifth Annual Meeting in Kiev, Ukraine, May, 1928.

LENINGRAD ROENTGEN RAY SOCIETY
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly on the first Monday at 8 o'clock in the State Institute of Roentgenology and Radiology, Leningrad.

MOSCOW ROENTGEN RAY SOCIETY
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with the exception of the Denmark Society, meets every second month except in the summertime:

SOCIETY OF MEDICAL RADIOLOGY OF SWEDEN
Meets in Stockholm.

SOCIETY OF MEDICAL RADIOLOGY IN NORWAY
Meets in Oslo.

SOCIETY OF MEDICAL RADIOLOGY IN DENMARK
Secretary, Dr. H. Scheuermann, Copenhagen
Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

SOCIETY OF MEDICAL RADIOLOGY IN FINLAND
Meets in Helsingfors.

VIENNA SOCIETY OF ROENTGENOLOGY
Secretary, Professor Holzknecht, Vienna, IX, General Hospital.
Meets on the first Tuesday of each month from October to July.

ITINERARIES TO THE SECOND INTERNATIONAL CONGRESS OF RADIOLOGY IN STOCKHOLM*

ITINERARY NO. 1

June 2	Leave New York by S. S. Arabic—berth at $160 included.
June 11	Arrive Cherbourg and Paris.
June 12, 13, 14, 15, 16	Paris. Two motor drives around the city. Motor excursion to Malmaison and Versailles, chateaux, gardens, and trianons. Motor excursion to Fontainebleau, chateau, forest and Barbizon.
June 17	To Frankfort.
June 18, 19, 20, 21, 22	Frankfort and Wiesbaden.
June 23	To Munich.
June 24, 25	Munich. City drive including Royal Estates of Nymphenburg.
June 26	To Vienna.
June 27, 28, 29, 30, July 1, 2	Vienna. Motor tour of city. Motor excursion to Schonbrun.
July 3	To Prague.
July 4	Prague. Motor tour.
July 5	To Berlin.
July 6, 7, 8, 9, 10, 11	Berlin. Motor tour of city. Motor excursion to Potsdam.
July 12	To Hamburg.
July 13, 14, 15, 16, 17	Hamburg. Motor tour of city.
July 18	To Copenhagen.
July 19, 20, 21	Copenhagen. Motor tour, including N. Sealand and Kronborg.
July 22	To Stockholm, by sleeper.
July 23, 24, 25, 26, 27	Stockholm—Congress.
July 28	Sail from Gotenburg.
July 29	At Sea.
July 30	Arrive London.
July 31, Aug. 1, 2, 3	London. Motor tour of city. Motor excursion to Windsor, Eton and Hampton Court.
Aug. 4	Sail from Southampton by S. S. Lapland—berth at $150 included.
Aug. 13	Arrive New York.
	Price: First-class Hotels ... $1045 Temple Tour Standard Hotels ... 945

EXTENSION

Aug. 4	To Edinburgh.
Aug. 5, 6, 7	Edinburgh. Motor excursion to Melrose and Abbotsford.
Aug. 8	Glasgow.
Aug. 9	Motor excursion through the Trossachs—"Lady of the Lake." Country.
Aug. 10	Excursion to Ayr—The Burns Country.
Aug. 11	Sail by S. S. ...

*Submitted by Temple Tours, Inc. 350 Madison Ave., New York City.

Aug. 19	Arrive Montreal.
	Price: First-class Hotels.... $120
	Temple Tour Standard Hotels..... 105

ITINERARY NO. 1-A

June 9	Leave New York by S. S. Caronia—berth at $160 included.
June 18	Arrive Havre and Paris.
June 19, 20, 21, 22, 23, 24	Paris. Two motor drives around the city. Motor excursion to Malmaison and Versailles, chateaux, gardens and chateau, forest and Barbizon.
June 25	To Frankfort.
June 26, 27	Frankfort.
June 28	To Munich.
June 29, 30, July 1	Munich. City drive including Royal Estates of Nymphenburg.
July 2	To Vienna.
July 3, 4, 5, 6, 7	Vienna. Motor tour of city. Motor excursion to Schonbrun.
July 8	To Prague.
July 9, 10	Prague. Motor tour.
July 11	To Berlin.
July 12, 13, 14	Berlin. Motor tour of city. Motor excursion to Potsdam.
July 15	To Hamburg.
July 16, 17, 18	Hamburg. Motor tour of city.
July 19	To Copenhagen.
July 20, 21	Copenhagen. Motor tour, including N. Sealand and Kronborg.
July 22	To Stockholm, by sleeper.
July 23, 24, 25, 26, 27	Stockholm—Congress.
July 28	Sail from Gotenburg.
July 29	At Sea.
July 30	Arrive London.
July 31, Aug. 1, 2, 3	London. Motor tour of city. Motor excursion to Windsor, Eton and Hampton Court.
Aug. 4	Sail from Southampton by S. S. Lapland—berth at $150 included.
	Price: First-class Hotels.... $1005
	Temple Tour Standard Hotels..... 910

EXTENSION

Aug. 4	To Edinburgh.
Aug. 5, 6, 7	Edinburgh. Motor excursion to Melrose and Abbotsford.
Aug. 8	Glasgow.
Aug. 9	Motor excursion through the Trossachs—"Lady of the Lake" Country.
Aug. 10	Excursion to Ayr—The Burns Country.
Aug. 11	Sail by S. S. .....
Aug. 19	Arrive Montreal.
	Price: First-class Hotels.... $120
	Temple Tour Standard Hotels..... 105

ITINERARY NO. 2

July 5	Leave New York, S. S. Gripsholm—berth at $240 included.
July 14	Arrive Gotenburg.
July 15	Gotenburg.
July 16	To Oslo.
July 17, 18	Oslo.
July 19	To Rattock.
July 20, 21	Rattock.
July 22	To Stockholm.
July 23, 24, 25, 26, 27	Stockholm—Congress.
July 28	To Copenhagen, by sleeper.
July 29, 30	Copenhagen. Motor tour, including N. Sealand and Kronborg.
July 31	To Hamburg.
Aug. 1, 2	Hamburg. Motor tour of city.
Aug. 3	To Berlin.
Aug. 4, 5, 6, 7	Berlin. Motor tour of city. Motor excursion to Potsdam.
Aug. 8	To Vienna.
Aug. 9, 10, 11	Vienna. Motor tour of city. Motor tour to Schonbrun.
Aug. 12	To Munich.
Aug. 13	Munich. City drive including Royal Estates of Nymphenburg.
Aug. 14	To Frankfort.
Aug. 15, 16, 17, 18	Frankfort.
Aug. 19	To Paris.
Aug. 20, 21, 22, 23, 24	Paris. Two motor drives around the city. Motor excursion to Malmaison and Versailles, chateaux, gardens and trianons. Motor excursion to Fontainebleau, chateau, forest and Barbizon.
Aug. 25	To Cherbourg and sail S. S. Tuscania—berth at $160 included.
Sept. 3	Arrive New York.
	Price: First-class Hotels.... $1040
	Temple Tour Standard..... 945

EXTENSION

Aug. 25	To London.
Aug. 26, 27, 28, 29, 30, 31	London. Motor tour of city. Motor excursion to Windsor, Eton and Hampton Court.
Sept. 1	To Edinburgh.
Sept. 2, 3, 4	Edinburgh. Motor excursion to Melrose and Abbotsford.
Sept. 5	Glasgow.
Sept. 6	Motor excursion through the Trossachs—"Lady of the Lake" Country.
Sept. 7	Excursion to Ayr—the Burns country.
Sept. 8	Sail by S. S. .....
Sept. 16	Arrive Montreal.
	Price: First-class Hotels.... $220
	Temple Tour Standard Hotels..... 195

ITINERARY NO. 3

July 5	Leave New York by S. S. "Gripsholm"—$225 berth included.
July 14	Arrive Gotenburg.
July 15	Gotenburg.
July 16	To Oslo.
July 17, 18	Oslo.
July 19	To Rattvik.
July 20, 21	Rattvik.
July 22	To Stockholm.
July 23, 24, 25, 26, 27	Stockholm—Congress. Sleeper to Gotenburg.
July 28	Leave Gotenburg by S. S. "Gripsholm"—$105 berth included.
Aug. 6	Arrive New York.
	Price: First-class Hotels.... $610

ITINERARY NO. 3—SUBSTITUTE

July 11	Leave New York S. S. "Aquitania," $165 berth included.
July 17	Arrive Southampton and London.

July 18	London.
July 19	To Newcastle and sail.
July 21	Arrive Bergen.
July 22	Arrive Stockholm.
July 23, 24, 25, 26, 27	Stockholm—Congress.
July 28	Sail by S. S. "Gripsholm" $195 berth included.
Aug. 6	Arrive New York.
	Price: First-class Hotels.... $545

ITINERARY No. 3-A

July 7	Leave New York, S. S. "Stavangerfjord" $165 berth included.
July 16	Arrive Bergen.
July 17	Bergen.
July 18	To Oslo by the scenic route.
July 19	Oslo.
July 20, 21	Rattvik
July 22	To Stockholm.
July 23, 24, 25, 26, 27	Stockholm—Congress.
July 28	Sail by S. S. "Gripsholm" $195 berth included.
Aug. 6	Arrive New York.
	Price: First-class Hotels.... $520

ITINERARY No. 4

June 9	Sail from New York S. S. "Adriatic" $150 berth included.
June 18	Arrive Liverpool and Edinburgh.
June 19, 20, 21	Edinburgh. Motor excursion to Melrose and Abbotsford.
June 22, 23	Glasgow. Excursion to Ayr—Burns' Country. The Trossachs "Lady of the Lake" Country.
June 24, 25	The Lake District, by coach and steamer.
June 26	By the Shakespeare Country, Stratford-on-Avon, Warwick, Kenilworth and to London.
June 27, 28, 29, 30,	London. Motor tour of the city.
July 1	Motor excursion to Windsor, Eton and Hampton Court.
July 2	To Paris.
July 3, 4, 5, 6, 7	Paris. Two motor drives around the city. Motor excursion to Malmaison and Versailles, chateaux, gardens and trianons. Motor excursions to Fontainebleau, chateau, forest and Barbizon.
July 8	To Frankfort.
July 9, 10, 11	Frankfort.
July 12	To Hamburg.
July 13, 14, 15	Hamburg. Motor tour of the city.
July 16	To Copenhagen.
July 17, 18	Copenhagen. Motor tour.
July 19	To Oslo.
July 20, 21	Oslo.
July 22	To Stockholm.
July 23–27	Stockholm—Congress.
July 28	Sail—S. S. "Gripsholm" $195. berth included.
Aug. 6	Arrive New York.
	Price: First-class Hotels.... $980

EXTENSION

July 29	To Copenhagen.
July 30	Copenhagen. Motor tour.
July 31	To Berlin.
Aug. 1, 2, 3, 4	Berlin. Motor tour of city. Motor excursion to Potsdam.
Aug. 5	To Prague.
Aug. 6, 7	Prague. Motor tour.
Aug. 8	To Vienna.
Aug. 9, 10, 11	Vienna. Motor tour of city. Motor excursion to Schonbrun.
Aug. 12	To Munich.
Aug. 13	Munich. City drive including Royal Estates of Nymphenburg.
Aug. 14	Strassbourg.
Aug. 15	To Paris.
Aug. 16, 17	Paris.
Aug. 18	Sail S. S. "Caronia" $165 berth included.
Aug. 27	Arrive New York.
	Price: $295 extra.

ITINERARY No. 5

July 7	Sail from New York, S. S. "Stavangerfjord" berth at $165 included.
July 16	Arrive Bergen.
July 17	Bergen, in the afternoon leave for Tennereid and motor to Norheimsund.
July 18	Steamer on Hardanger Fjord to Ulvik.
July 19	Motor via Voss to Stalheim.
July 20	To Gudvangen on Nearo Fjord, and by motor to Balholmen on Sogne Fjord.
July 21	To Myrdal and Naerodal.
July 22	To Stockholm.
July 23, 24, 25, 26, 27	Stockholm—Congress.
July 28	Sail by S. S. "Gripsholm" berth at $195 included.
August 6	Arive New York.
	Price: $530

Itinerary No. 5 is especially recommended by Dr. and Mrs. Pfahler.

WHAT OUR PRICES INCLUDE

Steamship Accommodation at price quoted. Higher priced accommodation can be secured for those who wish.

European Transportation. In Continental countries, second-class; in England, second-class, or third class on railways that have abolished second. On all river, lake and channel steamers, first class.

Automobile and Carriage Trips.

Sightseeing. Admission to museums, galleries and other points of interest, together with the necessary fees to caretakers and the cost of transportation to these places (automobile fare, etc.).

Hotel Accommodation. Room and breakfast, luncheon and dinner at moderate priced first class hotels.

Taxes. United States War Tax, landing tax at foreign ports, taxes de luxe, taxes de sejour, etc.

All necessary fees at hotels and elsewhere, except on Atlantic and North Sea steamers.

Transfers between stations, docks and hotels.

Services of a Conductor. Obliging and competent and with previous experience in European travel. Special guides in many places.

Baggage. We will give each party member (taking at least thirty days of land travel) a special portmanteau, 16 × 15 × 24 inches. It has a tray and will hold 50 per cent more than the average suitcase. This is looked after by our conductor and transported throughout the trip at our expense.

Services of Our Passport Department.

ITINERARIES TO THE SECOND INTERNATIONAL CONGRESS OF RADIOLOGY IN STOCKHOLM*

Tour No. 1

Wed.	May	30	Sail from New York on the S. S. "Lancastria" of the Cunard Line, Cabin berths at the value of $160.00 with tax provided.
Fri.	June	8	Due Cherbourg thence to Paris. Hotel Lutetia.
Sat. to Wed.	June	7 20	In Paris—a day's drive in a private motor charabanc with guide will be provided about the city. A day's trip by motor coach will also be made to Malmaison and Versailles.
Thurs.	June	21	By day express via Metz to Frankfort. Hotel Bristol or Hotel Imperial.
Fri. to Tues.	June	22 26	In Frankfort—a day's drive about the City will be made in private motors under the direction of a competent guide.
Wed.	June	27	By morning train to old Nuremberg, Hotel Wurtenburger Hof.
Thurs.	June	28	By day train to Vienna, Hotel Imperial.
Fri. to Tues.	June	29 3	In Vienna—a day's drive in a private motor charabanc with guide will be provided about the City.
Wed.	July	4	By morning train to Prague, Hotel Palais du Passage.
Thurs.	July	5	By express to Berlin, Hotel Central or Hotel Bristol.
Fri. to Tues.	July	6 10	In Berlin. Two drives with guide will be provided in a private motor charabanc; (*a*) Half day trip about Berlin, (*b*) Day's trip to Potsdam.
Wed.	July	11	By morning train to Hamburg, Hotel Atlantic.
Thurs. to Mon.	July	12 16	In Hamburg—a day's drive about the City with guide will be provided in private motors. Leave Monday evening in sleeping car for Copenhagen—sleepers included.
Tues.	July	17	In Copenhagen, Hotel Palads—a day's drive in private motors with guide will be provided about the City.
Wed.	July	18	By day train to Gothenburg, Hotel Eggers.
Thurs.	July	19	In Gothenburg—a drive in private motors, with guide will be provided about the City.
Fri.	July	20	Sail in the morning on one of the fine steamers of the Gota Canal.
Sat.	July	21	En route on the Gota Canal across Sweden.
Sun.	July	22	Arrive Stockholm in the late afternoon.
Sun. to July 28	July	22	In Stockholm. No hotel accommodations will be provided.
Sun.	July	29	By day train to Rattvik in the heart of Delecailia, Hotel Siljansborg.
Mon.	July	30	In Rattvik. A drive in private motors
Tues.	July	31	will be made about Lake Siljan.
Wed.	Aug.	1	By day train to Oslo, Grand Hotel.
Thurs.	Aug.	2	In Oslo—a day's drive about the City in private motors with guide will be provided.
Fri.	Aug.	3	By rail via the scenic Bergen-Oslo Railway, over the Norwegian Alps to Bergen. Hotel Norge.
Sat.	Aug.	4	Sail on S. S. "Leda" or the S. S. "Jupiter," first-class accommodations provided.
Sun.	Aug.	5	Arrive Newcastle-on-Tyne, thence to Edinburgh, Hotel Royal.
Mon. to Wed.	Aug.	6 8	In Edinburgh. A drive with the guide will be provided about the City.
Thurs.	Aug.	9	By afternoon express to London, Hotel Langham.
Fri. to Wed.	Aug.	10 15	In London. A day's drive in a private motor charabanc with guide will be made about the City. A day's trip by motor coach will also be made to Windsor, Stoke Poges, Hampton Court, etc.
Thurs.	Aug.	16	To Southampton and sail on the S. S. "America" of the United States Lines. Cabin berths at the value of $145 provided.
Sat.	Aug.	25	Due New York.

* Submitted by the Walter H. Woods Co., 80 Boylston Street, Boston, Mass.

Tour No. 2

Thurs.	July	5	Sail from New York on the S. S. "Gripsholm" of the Swedish American Line. First-class accommodations at the value of $200 provided.
Sat.	July	14	Arrive Gothenburg, Hotel Eggers.
Sun.	July	15	In Gothenburg. A drive in private motors with guide will be provided about the City.
Mon.	July	16	By day train to Oslo, Grand Hotel.
Tues.	July	17	In Oslo—a day's drive about the City
Wed.	July	19	in private motors with guide provided.
Thurs.	July	19	By day train to Rattvik, Hotel Siljansborg.
Fri.	July	20	In Rattvik. A drive in private motor will be provided about Lake Siljan.
Sun.	July	22	By day express to Stockholm.
Sun. to Fri.	July	22 27	In Stockholm. No hotel accommodations provided.
Sat.	July	28	Sail in the evening on the new S. S. "Drotten" for Visby.
Sun.	July	29	Arrive in Visby in the morning. A visit will be made to the old walls and ruins. Sail in the early afternoon on the S. S. Visby across the Baltic and through the Kalmar Sound.
Mon.	July	30	Arrive Kalmar in the morning where a visit will be made about the old City. By afternoon train to Copenhagen. Hotel Palads.
Tues.	July	31	In Copenhagen. A day's drive in private motors with guide will be provided about the City.
Wed.	Aug.	1	By day train via Gjedser-Warnemunde to Hamburg. Hotel Atlantic.
Thurs. to Sun.	Aug.	2 5	In Hamburg. A drive about the City with guide will be provided in private motor cars.
Mon.	Aug.	6	By morning train to Berlin, Hotel Central or Hotel Bristol.
Tues. to Sat.	Aug.	7 11	In Berlin. Two drives with guide will be provided in a private motor coach; (*a*) Half day trip about Berlin, (*b*) Day's trip to Potsdam.
Sun.	Aug.	12	By express to Prague, Hotel Palais du Passage.
Mon.	Aug.	13	By express to Vienna, Hotel Imperial.
Tues. to Sat.	Aug.	14 18	In Vienna. A day's drive in private motor coach with guide will be provided about the City.

Sun.	Aug. 19	By day express to Nuremberg, Hotel Wurtenburger Hof.
Mon.	Aug. 20	By afternoon train to Frankfort, Hotel Bristol or Hotel Imperial.
Tues. to Sat.	Aug. 21 to Aug. 25	In Frankfort. A day's drive in private motors with guide will be provided about the City.
Sun.	Aug. 26	By day train via Metz to Paris, Hotel Lutetia.
Mon. to Fri.	Aug. 27 to Sept. 7	In Paris. A day's drive in a private motor coach with guide will be made about the City. A day's trip by motor coach will also be made to Malmaison and Versailles.
Sat.	Sept. 8	By day service via Calais-Dover to London, Hotel Langham.
Sun. to Fri.	Sept. 9 to Sept. 14	In London. A day's drive in a private motor coach with guide will be made about the City. A day's trip by motor coach will be made to Windsor, Stoke Poges, Hampton Court, etc.
Sat.	Sept. 15	To Southampton and sail on the S. S. "Caronia," of the Cunard Line. Cabin berths at the value of $145 provided.
Mon.	Sept. 24	Due New York.

Tour No. 3

Thurs.	July 5	Sail from New York on the M. S. "Gripsholm" of the Swedish American Line. First-class accommodations at the value of $200 with tax provided.
Sat.	July 14	Due Gothenburg, Hotel Eggers.
Sun.	July 15	In Gothenburg. A drive in private motors will be provided about the City.
Mon.	July 16	By day train to Oslo, Grand Hotel.
Tues.	July 17	In Oslo—a day's drive in private motors with guide provided about the City.
Thurs.	July 19	By day train to Rattvik, Hotel Siljansborg.
Fri.	July 20	In Rattvik. A drive in private motors
Sat.	July 21	will be taken about Lake Siljan.
Sun.	July 22	By day express to Stockholm.
Sun. to Fri.	July 22 to July 27	In Stockholm. No hotel accommodations or sightseeing provided.
Fri.	July 27	Leave Stockholm in the evening in sleeping car. Berth provided.
Sat.	July 28	Arrive Gothenburg and sail on the M. S. "Gripsholm" First-class accommodations, at the value of $195 provided.
Mon.	Aug. 6	Due New York.

ADDITIONAL ITINERARY FURNISHED BY THOS. COOK & SONS

Tour No. 9

July 7th	Sail from New York per S. S. "Stavangerfjord."
July 16th	Arrive Bergen.
July 17th	By steamer to Trengereid and motor bus to Norheimsund.
July 18th	Steamer on Hardanger Fjord to Uloik.
July 19th	Motor bus via Voss to Stalheim.
July 20th	To Gudvangen and steamer to Balholm.
July 21st	Return to Gudvangen.
July 22nd	Motor and trail through Naerdalen to Myrdal. Continue by rail to Oslo and night train to Stockholm. (Sleeper provided.)
July 23rd to July 27th	*At Stockholm.* No hotel accommodation or sight seeing to be provided here by Thos. Cook & Son. Leave on night train for Gothenburg. (Sleeper provided.)
July 28th	Arrive Gothenburg and sail for New York per S. S. "Gripsholm."
Aug. 6th	Arrive New York.

Cost of the above itinerary is $138.00 for each person in a group of ten with a minimum additional cost of $152.50 plus $5.00 tax for the ocean trip on the "Stavangerfjord" and a minimum of $195.00 for homecoming trip on the "Gripsholm." This trip is especially recommended by Dr. and Mrs. Pfahler.

ACKNOWLEDGMENT OF CREDIT

To the Editor:

In our article "A Combined Treatment for Cancer of the Esophagus," which appeared in the American Journal of Roentgenology and Radium Therapy, October, 1927, we regret having neglected to mention that the roentgenographic and roentgenoscopic examination of the patient mentioned in our article was done for us by Dr. Jacob Buckstein, in charge of this work in the radiographic department of Bellevue Hospital. We should appreciate your making note of this item in the next publication of your Journal.

Appreciating your courtesy, we remain

Very truly yours,

Pol Coryllos.

Ira I. Kaplan.

ELECTION OF OFFICERS, NEW YORK ROENTGEN SOCIETY

The following officers have been elected by the New York Roentgen Society for the coming year: Dr. George M. MacKee, President; Dr. E. Everett Rowell, Secretary. It will also be noted in our list of roentgen societies that the time of meetings of the New York Roentgen Society has been changed to the third Monday of each month.

INTERNATIONAL ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

ARNSTAM, O. I., and REINBERG, S. A. Clinical importance of metrosalpingography. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 64–73.

With careful technique metrosalpingography by means of lipiodol is entirely safe and easily performed. It may be regarded as an invaluable diagnostic aid within a certain limited field. The appearance of lipoidol in the abdominal cavity as characteristic circular shadows may be considered as absolute proof of patency of one or both fallopian tubes. Even though the diagnosis of non-patency by this method cannot be considered of the same order of reliability yet the procedure remains foremost amongst the methods of examination for the recognition of non-patency.

Metrosalpingography offers a means for determining the success attained by operative measures in restoring patency of the tubes. With the help of this method the topical diagnosis of uterine tumors is augmented and the contrast procedure is especially valuable in the differential diagnosis between submucous and intramural myomas. A diagnosis of pregnancy in the first weeks can be established by metrography when only the probability of such a diagnosis can be decided by other methods. Brief descriptions are given of 14 cases illustrating the various applications of the method.

AUSTRIAN, CHARLES R. The value of the roentgen ray as a diagnostic aid in the diagnosis of pulmonary and pleural diseases. *Am. J. M. Sc.*, June, 1927, clxxiii, 753–763.

Roentgenography has assumed a rôle of increasing importance in the diagnosis of thoracic disease but practiced as it is today by many, the use of it may be more hurtful than helpful. If the real utility of the method is to be realized, those who employ it must be trained in anatomy, pathology, physiology and clinical medicine. They must be workers who are informed of what is normal roentgenographically in the various decades of life. They must know that no examination of the chest is complete without it; but that it cannot take the place of a careful physical examination. They must understand that the roentgen ray cannot discover fever, râles and constitutional symptoms, although it may reveal the probable cause of these manifestations.

Such workers informed of these fundamental facts, as well as of the specific limitations mentioned, will bring to the clinician data that may confirm or deny the findings elicited by other methods, disclose the presence of undetected foci of disease, localize them, reveal their extent and texture and record graphically progressive and retrogressive changes as they develop over periods of time. However, such data suggestive though they may be, cannot finally determine the etiology of the abnormalities disclosed or say whether or not clinical disease exists.

In the study of diseases of the lower respiratory tract the roentgen ray is useful from several standpoints: (1) it is a valuable control of the accuracy of the data furnished by other means of physical examination and thus furnishes an appraisal of the usefulness of these methods; (2) it serves accurately to locate, outline and determine the extent of disease foci; (3) it may disclose a focus causing symptoms in patients in whom physical examination fails to discover it, because of its location or because it is masked by other conditions; (4) it gives a graphic record so that the advance or regression of the pathological process may be followed accurately.

BAASTRUP, CHR. I. Some roentgen pictures of the inner surface of the stomach under pathological conditions. *Acta radiol.*, 1926, vi, 122–127.

A description is given of several cases in which the information obtained by ordinary roentgenography after a Rieder meal received valuable extension and support by details revealed in pictures of the internal surface of the stomach obtained by the author's method. There was one case of resection of the stomach in which the lines of barium converged to an acute angle which evidently marked the cicatrix formed by the resection. There were 3 cases of spastic hour-glass stomach without visible niche in which the manner of convergence of the barium lines suggested evidence of the presence of a cicatrix from an old ulcer.

BARCLAY, A. E. The dangerous art of palpation. *Acta radiol.*, 1926, vi, 135–140.

Roentgenoscopic palpation is an art that requires experience and practice. By combining the senses of sight and touch one can obtain information that cannot be gained in any other way. Using the first mouthful of fluid opaque food, all the folds of the mucous membrane of

the stomach can be "combed out" and the craters of ulcers detected. Other irregularities in outline can be demonstrated with more certainty and the presence of tumors and adhesions definitely proved in otherwise doubtful cases. Systematic palpation adds a great deal to the accuracy of the diagnosis, but it does not replace roentgenograms and must not be an excuse for faulty roentgenographic technique.

BENTZON, P. G. K. Pathogenesis of coxa plana (Calvé-Legg-Perthes-Waldeström's disease) and other manifestations of "local dyschondroplasia." *Acta radiol.*, 1926, vi, 155–172.

Studies were made with the aim of answering the following questions: (1) Is it likely that coxa plana (and other kinds of "local dyschondroplasia") is caused by a lesion of the arteries of the bones? (2) May the formation of cartilage in the osseous tissue and the other pathological changes observed in this disease be referred to as abnormal arterial hyperemia in the osseous tissue?

To answer the first question, an anatomical study was made of the arteries of the bones in the cadaver and in amputated limbs. Injections were made with cinnabar-gelatin solution, and the course of the arteries was then studied in stereo-roentgenograms. It was found that the course of the arteries to the head of the femur, to the distal parts of the lower epiphysis of the femur, to the capitulum humeri and to the capitulum metatarsi is such that it seems likely that these arteries are exposed in an unusual degree to mild lesions (pressure or stretching) in young individuals where a pressure or blow may produce bending of the epiphyseal cartilage and not an actual epiphysiolysis. If the arteries are exposed to such mild lesions, it is not beyond the range of possibility that the vasomotor nerves in the adventitia may be injured, causing the nerves to be blocked thereby producing active hyperemia in the epiphyseal nucleus.

By paralyzing the vasomotor nerves of the upper epiphysis of the femur in young rabbits and goats by means of alcohol injections around the arteries, the author was able sometimes to produce pathological changes in the hips; and the histological examination of these changes showed a picture similar to the findings in coxa plana. Accordingly, these observations support the author's theory that the pathological changes in coxa plana, osteochondritis dissecans in the knee and in the capitulum humeri, and in Köhler's disease in the capitulum metatarsi, are caused by an active hyperemia produced by a mild lesion of the arteries of the bones.

BOARDMAN, W. W. The relative value of cholecystography and the original Lyon test in estimating biliary tract function. *Am. J. M. Sc.*, October, 1927, clxxiv, 536–542.

Cholecystography by the oral method of dye administration is at present reliable only if normal function is demonstrated. Findings other than normal should be checked by the intravenous method. There is approximately a 50 per cent agreement between the evidence of functional activity of the biliary tract as furnished by cholecystography and by the "B" bile of the Lyon test with magnesium sulphate. The character of the "B" bile obtained after a Lyon drainage is apparently dependent upon the degree of emptying of the gall-bladder. Dark brown "B" bile is associated with marked emptying and golden brown "B" bile with slight emptying.

The magnesium sulphate as used in the Lyon test may fail to induce emptying in a gall-bladder capable of emptying in response to other stimuli. Also the magnesium sulphate may induce sufficient emptying in some definitely pathologic gall-bladders to produce a normal "B" bile although cholecystography shows definite evidence of disturbed function. From this it is apparent that the original Lyon test (the intraduodenal administration of magnesium sulphate solution and the observation of the resulting bile flow), when used as a measure of biliary tract function is less dependable than cholecystography. In fairness to the Lyon test it must be emphasized that in the hands of careful experienced investigators the examination of the sediment and in the occasional case the bacteriological findings, may furnish evidence of clinical value.

BORDONI, LUIGI. Symptomatic spasm in the digestive tract. *Arch. di radiol.*, Mar.–Apr., 1927, iii, 351–361.

The author describes a case of spasm of the middle two-thirds of the esophagus in a woman of sixty who had carcinoma of the cardia, and one of spasm of the descending colon in a man aged fifty-eight who had a carcinoma of the rectum. Roentgen examination did not show any local cause for the spasm in either case. These spasms are due to reflex action and the author calls them symptomatic spasms or warning spasms. He thinks there is no such thing as real idiopathic spasm or if it exists it is at least extremely rare but these warning spasms due to some pathological condition at a

distance are relatively frequent and in any case of spasm without a demonstrable local cause a careful search should be made for the distant cause.

BRONNER, H. Calcification of the pineal body in the roentgenogram. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 277–281.

In a series of 70 consecutive roentgenograms of the skull, the author found 21 (30 per cent) distinctly positive with calcification in the pineal region; there were in addition 18 (25.7 per cent) positive but of no clinical importance. The remainder, 31 (44.3 per cent), were negative. Analysis of these observations according to the age of the patients indicates that results of clinical value are absent in the first two decennia. Between the second and sixth decennia the frequency of this clinical finding is relatively great (37 per cent). Depending on the degree of calcification the roentgenogram will show finely spotted or diffuse shadows in the pineal region. Recognition of these structures is easier in the lateral than in the fronto-occipital view; and if exposure is made in the latter direction the central ray must run parallel to the base of the skull in order to avoid interference from the frontal sinuses. During the exposure for the lateral roentgenogram care must be taken to hold the head exactly horizontal and sagittal with respect to the tube and film. Then the position of the pineal shadow lying exactly in the median plane is a constant one so that abnormal displacements can be recognized and used in the diagnosis of intracranial disease processes.

BRUNETTI, LUDWIG. Further reply to Claus regarding the shape of fluid levels on the roentgenogram of diseased nasal sinuses. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 283–286.

The author shows that theoretically in the roentgen picture of any curved surface, no matter what its nature, any angle of incidence of the rays must give rise to a convex distortion so that a convex surface will be more strongly convex, a flat surface will be slightly convex and a concave surface will appear less concave. The author gives a detailed discussion of the problem.

Dr. Claus in reply points out that the question is, what is the cause of the convex fluid line in the roentgenogram of diseased nasal sinuses and that in his opinion this is dependent largely on the content of mucus which determines the surface tension of the secretion. The important point from the diagnostic standpoint is that a convex fluid level in the roentgenogram of diseased nasal sinuses indicates the presence of a viscous fluid.

CAMPIONE, GIACOMO. The roentgen picture of aneurysm of the thoracic aorta. *Arch. di radiol.*, Mar.–Apr., 1927, iii, 289–319.

Twenty-five cases of aneurysm were examined; 3 were of the ascending aorta, 4 of the descending aorta with simple dilatation of the arch, 1 of the arch with the dilatation chiefly in the ascending part of it, 1 of the arch, chiefly the concave portion, 3 of the arch, chiefly of the convex part, 4 of the ascending aorta, all the arch and the descending aorta, 5 of the arch and descending aorta, 1 of the left flexure, 2 of the left flexure and the thoracic aorta. These examinations showed that aneurysm localized only in the descending aorta is rare, and in fact it is exceptional for a small localized aneurysm to be found on roentgen examination, for the patient does not come for examination generally until all or a large part of the aorta has become involved. The most frequent form of aneurysm is saccular. Fusiform ones are rarer and are generally localized in the ascending aorta or thoracic part. It is sometimes difficult when the whole aorta is involved to make a distinction between simple dilatation and aneurysm; an oblique picture is the best for making the diagnosis in these cases. But this examination too is often difficult on account of conditions in the mediastinum or because there is also sometimes dilatation of the beginning of the great vessels. Some of the aneurysms were as big as the head of a fetus, extending into one of the halves of the thorax and occupying almost a third of it. In some cases there were multiple sacs implanted on the ascending portion and the beginning of the descending. These patients died a few days after coming under observation. Sometimes the aneurysm extended upward to the insertion of the first rib, but there was never erosion of bone.

Sometimes the clinical diagnosis was not in harmony with the roentgen findings as the symptoms were misleading. For instance one case was sent for emergency treatment: the patient presented intense dyspnea, cyanosis, bloody expectoration, pain in the left side of the thorax, small pulse, clouded consciousness, no fever; objectively there was only slight mobility of the left half of the thorax, dullness from the apex down to the 4th intercostal space, diffuse râles, heart a little enlarged toward the left with a soft murmur at the apex on the first sound and a rough murmur at the base on the second sound. The clinical diagnosis was infarct of the lung. The roentgen examination showed an enormous aneurysm

of the left flexure with dilatation of all the rest of the arch, retraction of the left lung and complete opacity of the left half of the thorax. Matthes describes a case in which a large saccular aneurysm of the aorta was diagnosed as pleural effusion. Small aneurysms are frequently diagnosed as cardiac lesions. Roentgenoscopic examination is of great value in such cases. In patients with positive Wassermann reaction the size of the aneurysm may decrease under specific treatment.

CHIZZOLA, G. Ureteral calculus. *Arch. di radiol.*, Mar.–Apr., 1927, iii, 418–423.

A boy of sixteen began to have pain in the right renal region and disturbances of micturition three years ago. Roentgen examination at that time was negative. Since then he has had attacks of pain in the right renal region radiating downward, which lately have recurred every twenty to thirty days. Sometimes there has been blood in the urine. Roentgen examination showed two shadows at the level of the sciatic incisure 4.5 cm. from the midline, one above the other. They were round and uniform in density. They could not have been coproliths or foreign bodies in the intestine because of the care with which the patient had been prepared. They could not have been mesenteric glands or calculi of the peritoneum because they give less dense and more irregular shadows than these were. Besides that they are very mobile and these shadows were not. The clinical symptoms indicated calculi of the urinary tract and operation showed two calculi of the right ureter just above where it emptied into the bladder. Calculi of the ureter are rare in such young patients.

CIGNOLINI, PIETRO. The sagittal inclined positions in the roentgenoscopic study of the hilus of the lung. *Arch. di. radiol*, Mar.–Apr., 1927, iii, 449–454.

The author finds that by means of a posteroanterior projection with the patient bent far back and by an anteroposterior projection with him bent forward it is possible in many cases to detach gland shadows from the general opacity of the hilum and note changes in their density and outline. The hilum is made up of various tissues, including lung tissue, large bronchi, interlobar mediastinal pleura, pulmonary vessels, lymphatic vessels and lymphatic glands. Pathological changes in the lungs and bronchi rarely cause changes in the hilum shadow; it is generally changes in the vessels or glands. By using the above positions, varying the oblique incidence of the rays and having the patient turn first to the right and then to the left these shadows can be brought out.

COLANERI, L. J., and ROBERT, HENRI. Fractures of the coronoid process of the ulna. *J. de radiol. et d'électrol.*, May, 1927, xi, 265–270.

Fractures of the coronoid process may present four different pictures: (1) The process is fractured at its base; it is separated from its attachment to the ulna and displaced forward and downward. This is a total fracture. (2) Only the point of the process is torn off and separated from the rest of the ulna by a transverse line. The process is blunted. The fragment floats in the joint or is adherent to the capsule. This is an avulsion fracture. (3) There is an irregular line at the base with shifting of the fragments. This is a partial fracture. (4) The tip of the process is torn off as above and there is a fissure at the base. This combination may be called an incomplete fracture of the coronoid process. The first form is not particularly important from the point of view of roentgen examination as it can easily be diagnosed clinically. But the others are hard to diagnose without roentgen examination.

Four cases are described with roentgenograms. There was no doubt of a traumatic origin in these cases but there was no direct violence and the fractures were produced by indirect shock acting on the elbow, showing that fractures of the coronoid process can be produced in this way, contrary to the opinion of some authors. There was a luxation of the elbow on which a probable diagnosis could be based in only one of the cases and roentgen examination was necessary to show the fractures. A roentgen picture taken from in front is insufficient and a profile or oblique picture or stereoroentgenography is essential in order to show to which of the bones of the forearm the detached fragment belongs. The usual treatment of fracture of the tip of the coronoid process is about the same as that of sprain: massage and early mobilization.

CZEPA, ALOIS. Partial situs inversus of the viscera. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 90–92.

The case occurred in a woman aged thirty-six who was operated on for chronic appendicitis. On operation, the stomach and spleen were found on the right side and the liver in the left of the abdominal cavity. The appendix was in the left iliac fossa and appeared normal. After recovery from the operation the patient was given a roentgen examination. The right diaphragm was found to be considerably higher

than the left but it was otherwise freely movable. The examination of the intestines showed the ampulla, and the sigmoid, descending and transverse colon in an entirely normal position; on the other hand, the ascending colon and the cecum were displaced. The right colonic flexure was shifted horizontally toward the left so that the cecum lay over the left iliac crest.

D'Amato, Giuseppe. Further experiments with cholecystography. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 29–41.

For the diagnosis of gall-bladder disease the intravenous method of administering the contrast material is regarded as the method of choice. Roentgenograms should be taken with the patient standing and lying down. It is of importance in all cases to make a simultaneous examination of the stomach and intestines with a Rieder meal, for the demonstration of adhesions. A negative finding, assuming perfect technique in the intravenous injection, may be regarded as a proof of disease of the gall-bladder and the cystic duct rather than of a diminished liver function. In any case, this finding represents a very important pathologic sign. The position, form and size of the gall-bladder shadow vary considerably among the various patients and depend upon numerous circumstances. With the combined method one is enabled to diagnose adhesions when films, especially serial films of the duodenum, show constant deformation and displacements between the adherent organs and which do not disappear during the passage of peristaltic waves over the stomach and duodenum.

The stenosed gall-bladder is demonstrated more satisfactorily provided special technical precautions are taken. When the stenosis has been present for some time one is dealing with a more or less severely injured liver and a corresponding decrease in the ability of the cells to eliminate the dye. Consequently there results a delay in the appearance of the gall-bladder shadow upon the roentgenogram. Furthermore, stenosis causes dilatation of the organ and its musculature has lost much of its power of contraction and no longer reacts to injections of hypophysin. As a result of this the shadow is not so intense, for the bile with the contrast material is mixed with the bile already in the bladder. To bring out the gall-bladder shadows in such cases, one should use softer rays and augment the contrast by injection of air into the colon. Concretions appear as opacities in the gall-bladder shadow, but they may sometimes give a negative result when a spasm of the musculature forces the concretions toward the mouth of the cystic duct.

Detre, Georgs. The roentgen diagnosis of tuberculosis of the hilum in children. *J. de radiol. et d'électrol.*, May, 1927, xi, 257–264.

When a roentgenologist is called upon to make an examination of a child in whom tuberculosis of the lungs and hilum glands is suspected clinically he may find a distinct picture of adenopathy with periadenitis, showing tuberculosis of the hilum, the prognosis of which is generally favorable. These are not always the cases that are most suspicious clinically, and roentgenology renders valuable service in such cases. In other cases he finds a picture of glands that are calcified and sometimes decreased in size in the midst of a distinct hilum arborization, showing that the process is inactive. In other cases in spite of the clinical evidence he does not find anything but a hilus shadow which is increased in density or more indistinct than normal. It is questionable whether on the basis of such findings he should make a diagnosis of a sclerosis or a congestion. If he does so he runs the risk of making a diagnosis of tuberculosis of the hilum where it does not exist but, on the other hand, such findings should not be ignored. Perhaps the best thing is to simply report them to the practitioner and let him consider them in connection with his clinical findings.

Döhner, Bernhard. Chronic appendicitis in the roentgenogram. *Fortschr. a. d. Geb d. Röntgenstrahlen*, 1926, xxxv, 228–237.

From observation of more than 200 cases, it is concluded that the appendix can be visualized roentgenographically after oral administration of contrast material without any special expedients. In nearly all cases in which such an examination would be of interest, the appendix can be visualized with the patient in the standing posture. The first examination should be made four hours after administration of the contrast meal and then repeated every two hours. Sometimes feeding of the contrast meal must be repeated in the evening.

Only a combination of several symptoms justifies a diagnosis of appendicitis. Such symptoms are dilatation and hyperperistalsis of the terminal ileac loop, distortions of the cecum especially near the edge of the middle portion, definite fixation of the appendix, prominent defects in filling and unquestioned localization of a painful pressure point over the appendix. The roentgenographic evidence seems to suggest that in addition to Hirsch's sphincter, there also exists a closing sphincter of the

cecum which simultaneously influences the direction of the emptying of the ileum by displacement of the ileocecal valve.

Döhner, Bernhard. A further case of mesenterium commune. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 238–240.

The patient, a man aged thirty-five, was suffering from mild amebic dysentery but insisted on a complete examination. The roentgen examination revealed an interesting condition. The stomach appeared normal on first examination but another examination two hours after administration of the contrast meal revealed an unusual picture in the small intestine. Large masses of coils of jejunum and ileum were found located exclusively in the right side of the abdomen, and in addition to a small residue still present in the stomach the duodenum was filled but could not be visualized separately. After six hours the ileum was empty but its direction was pointed toward the left. It opened into the cecum which was not on the right but was located in the sacral hollow of the left pelvis.

The large intestine presented the same characters described by Altschul. The ascending colon pointed obliquely upward in the umbilical region, at which point the colon formed a flat flexure without extending beyond the midline and then turned sharply upward to the left to connect with an extremely elevated splenic flexure which was greatly distended. The descending colon followed a normal course down into the pelvis and bent into an atypical sigmoid often observed by the roentgenologist but not interpretable as pathologic. It extended almost up to the splenic flexure behind the descending colon and showed indentations similar to those in the splenic flexure and then turned back in almost a straight line to the small pelvis. This increased motility and the characteristic features of the haustral markings presented the typical picture of chronic colitis. A second examination permitted demonstration of the fact that the lower flexure of the duodenum was bent toward the left. The author also adds an additional feature not reported by Altschul, namely, that the appendix is also pointed in the opposite direction. The whole picture is not one of a simple intestinal displacement but of a congenital condition.

Dressen, Hans. Combination of roentgen and gastric juice examination of the stomach. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 78–83.

In the roentgen examination of the stomach with the aid of the contrast meal, the authors have found that fractional removal of the gastric juice formed can be carried out satisfactorily in all cases. By determining the acidity of these fractions and plotting the acid values against time, a secretion curve is obtained which may be combined with the roentgen examination to give an index of the secretory activity of the stomach. The acid values thus observed and especially the type of curve obtained, in spite of the inhomogeneous mixture of the usual contrast meal, do not differ appreciably from those obtained by the alcohol test drink. The procedure has been found applicable especially in ambulant cases and in instances where time saving is of importance.

Eisler, F., and Nyiri, W. Cholecystography according to Graham and Cole and its clinical significance. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 248–260.

The authors summarize their experience with 865 cases, of whom 88 were operated on. A normal gall-bladder capable of efficient contraction excludes with practical certainty the possibility of a diffuse pathologic change of the gall-bladder wall. In cases with normal liver function and icterus absent, failure of the gall-bladder to fill (provided there is no hydrops) indicates a diffuse pathologic process of the gall-bladder wall (cholecystitis, carcinoma, fibrous contraction). Gallstones may sometimes appear as light areas in the gall-bladder shadow.

These findings obtained by means of cholecystography may be supplemented by demonstration of engorged gall-bladders and very thick-walled pathological gall-bladders as well as calcareous stones all demonstrable by the ordinary roentgenographic examination. In cases with disturbance of liver function, a negative cholecystographic finding should be interpreted with the greatest caution. A combination of cholecystography with contrast filling of the gastrointestinal tract offers a basis for judging the mutual effects of these organs due to their proximity. In the experience of the authors the method of choice is the oral administration of the dye; this has shown a reliability of 95 per cent. The intravenous injection of tetraiodophenolphthalein should be tried only when there is a disagreement between the cholecystographic and clinical findings.

Feutelais, P. Lateral roentgenography of the pelvis. *J. de radiol et d'électrol.*, May, 1927, xi, 271–273.

A lateral examination of the pelvis helped the author to make a very difficult diagnosis. The patient was a woman aged thirty-one, who had

suffered from pain in her right hip for several years. She was treated for coxalgia. She still suffers pain on walking but there are no signs of arthritis of the coxofemoral joint. She has also had pain in her abdomen for some time which had been diagnosed as tuberculous peritonitis. She also complained of pain in her spinal column and a diagnosis of Pott's disease had been made, for which she was sent to the author. He decided that her condition was partly nervous and as the physicians had spoken before her of the necessity for wearing a plaster cast he had one applied for two months and she said she was greatly improved but as soon as it was removed she again complained of pain in the abdomen and pain in the lumbosacral region of the spine. There was a palpable mass beneath the umbilicus, and two of the author's colleagues suggested disease of the last two lumbar and first sacral vertebrae, but he did not agree with them because there was not the least contracture in hyperextension, which is a cardinal sign in lesions of the lumbar spinal column. Several examinations from in front showed a shadow masking the 4th and 5th lumbar and 1st sacral vertebrae. They also showed an old lesion of the right pubis and symphysis which explained the diagnosis of right coxalgia. A lateral view of the pelvis showed that the 4th and 5th lumbar vertebrae were intact but that there was a large mass in front of them which was not connected with the spinal column at all. It was an old osteoarthritis of the pubis as a result of which masses of inflamed glands had formed in front of the promontory. These masses explained the peritoneal reaction and the pain in the lumbar region but showed that the spinal column was normal.

GALDAU, D., and POP, A. Benign gastric tumors. A new case of gastric polyposis. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, XXXV, 270–272.

A report is given of a case occurring in a woman aged seventy-three. The roentgen examination showed a long ptotic, atonic stomach with the lower boundary 4 fingers width below the interspinal line. At the beginning there was a strong, deep, almost segmental peristalsis which continued without interruption down to the insufficient pylorus. Both curvatures were smooth. The pyloric bulb was constantly filled but appeared to have a normal contour. This suggests a reflex neurosis of the stomach. With pressure on the antral portion, there were observed several rounded, well-outlined, movable structures varying in size from a pea to a hazelnut. On releasing the pressure these structures disappeared from view. Emptying of the contrast material was rapid and the active and passive movements were free. After four hours, in spite of an early, rapid emptying and an insufficient pylorus a third of the barium was still present in the stomach. The roentgenograms confirmed the roentgenoscopic observations.

The diagnosis was: apparent probable gastric polyposis in the prepyloric region of the stomach. Operation was performed and although these structures showed no infiltration of the gastric wall and although no adhesions were present a gastric resection was done in view of the great possibility of malignant transformation. The resected portion showed extensive hypertrophic gastric folds, gastritis hypertrophicus.

This case showed the well-known roentgen signs, namely, preservation of the stomach shape, and filling defects of regular rounded, conglomerate islands. The clinical symptoms were also typical, namely, anemia, emaciation, anacidity.

GOTTHEINER, VIKTOR. The normal and pathological appendix in the roentgenogram. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, XXXV, 1–16.

The shape of the normal appendix in the roentgenogram is string-like and not like a ribbon. Ribbon-like shadows indicate an appendix turned upon itself, and therefore a stretched appendix. The lumen varies from the thickness of a knitting needle to that of a quill, and the length may vary all the way up to 8 cm. Longer appendices form the transition to pathological forms. The appendix always arises posterior to the fundus of the cecum and generally runs medially and downwards, seldom upwards; a lateral course is always pathological. In normal cases peristaltic movements are present only when the appendix is especially long. The time taken for an appendix to fill and empty depends on the condition of the rest of the gut. Retarded emptying is suspicious only under certain conditions when the rest of the gut is empty. Among the definite signs of pathologic appendix are mentioned: kink, irregular filling, narrowing or dilatation, situation lateral to the cecum, tuberous swellings, circumscribed acute appendicular tenderness, an isolated residue in the cecum and, in certain cases, isolated filling of the appendix. The following are enumerated as suspicious signs: immobility of the appendix shadow, segmentation, absence of shadow. Except when obliterated, the appendix can almost always be demonstrated roentgenographically with a little practice and without

special methods or apparatus. The author was frequently successful in indicating the correct diagnosis to the surgeon in cases which were clinically indicative of ulcers, cholecystitis, stone in the kidney, stone in the ureter, neurasthenia, etc., by locating the trouble in the appendix. Four cases are briefly cited.

HAENISCH, F. The roentgen diagnosis of gall-stones and the gall-bladder without contrast material. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 177–186.

The Graham method is recognized as a distinct advance in the diagnosis of gall-bladder conditions. However, for some time to come it will not be amongst the very simple roentgenological procedures; because, a more or less rigorous technique is demanded. The author reviews the findings that can be made by simple roentgenography of the gall-bladder region. The roentgen diagnosis is indispensable especially in cases of masked cholelithiasis but it demands great practice and experience. One must distinguish between the direct and indirect signs. Gallstones show up roentgenographically more or less depending on their calcium content, and the conditions for bringing out their shadows are discussed, as well as their typical shapes and their differentiation from other densities and opacities in the roentgenogram. The pathological gall-bladder produces a direct sign roentgenographically which may often be positively diagnosed. The indirect functional signs are of little importance and more emphasis must be laid upon the anatomical characters; and among these is the indentation of the contrasted pyloric antrum caused by the pathological gall-bladder.

HIRTZ, E. J. The roentgen signs of extension of deep sinus infections to the base of the skull and the mesencephalon. *J. de radiol. et d'électrol.*, June, 1927, xi, 305–320.

Inflammation of the sphenoid and ethmoid sinuses is very often accompanied by special roentgen signs, which are known to be due to the sinusitis because in cases of unilateral sinusitis they appear on only one side. These consist of veils at the base of the skull, most intense at the posterior ends of the ethmoid and sphenoid sinuses, and for this reason the author calls this condition a deep perisinusitis. These veils are apt to be very extensive and sometimes they cover the whole base to the posterior cerebral fossae and extend to the lateral part of the skull. The only possible cause for them is increased density due to reaction of the dura mater which is really the intracranial periosteum.

In deep sinusitis there are also certain malformations of the anterior clinoid processes and more particularly of the posterior ones. The processes show periostosis and hyperostosis but the original outlines of the process can be seen in the bony mass. There may be points of bone extending from the posterior toward the anterior processes. And there are abnormal pictures near the sella turcica such as bands, flaky spots and lines with a fibrous appearance which show a reaction on the part of the meninges and perivascular tissue. The pineal gland is frequently visible on account of fibrosis or calcification. It may be connected with the region of the sella by flaky lines. This change has also been shown to accompany deep sinusitis and not to occur under other conditions. These findings show that the infection of the sinus extends to the base of the skull, the meninges and the perivascular sheaths and affects the region of the pineal gland. But it is very probable that the real lesions are more extensive than the roentgen pictures show and that not only the meninges but the nerve tissue of the mesencephalic region is affected and this theory is supported by the clinical symptoms shown by patients with deep sinusitis.

KALBFLEISCH, WILLIAM K. The diagnosis of intestinal obstruction by roentgen-ray. *Am. J. M. Sc.*, October, 1927, clxxiv, 500–506.

In normal individuals the amount of gas in the small intestines is minimal. After a barium meal has been administered the three-hour roentgen picture shows the snowflake-like filling of the jejunum on the left side of the abdomen and the sausage-like appearance of the loops of the ileum lying in the true pelvis. In normal individuals there is not seen any fluid level. In the case of intestinal obstruction the picture is entirely different. The intestinal loops are distended with gas, and this can be readily recognized in studying the flat film. If the patient is placed in the upright position, the fluid in the intestinal loops will gravitate to the lowest parts and the gas will stand above it, thus producing horizontal fluid levels. One may therefore state that if the roentgenogram discloses distended loops of the small intestines with one or more distinct fluid levels even in the unprepared patient, one can make a diagnosis of intestinal obstruction. Furthermore, one may be able to determine the location of the obstruction from the position of these loops which are distended with fluid and gas. The author is of the opinion that in these cases one may dispense with a contrast medium, but the absolutely essential requirement is that the patient be examined in the upright position. An illustrative case is reported and discussed.

Lintz, William. Cholecystography and Lyon-Meltzer test in a patient with a congenitally absent gall bladder. *Am. J. M. Sc.*, May, 1927, clxxiii, 682–687.

The author gives a description of the first reported case, of a congenitally absent (confirmed by operation) gall-bladder in a woman aged 48 on whom cholecystography and the Lyon-Meltzer test were performed. The patient had a Riedel lobe of liver, and there was evidently an infection which had started in the common bile duct and ascended into the biliary ducts, ultimately involving the liver cells. The infection then travelled down the duct of Wirsung and involved the pancreas, particularly the islands of Langerhans, which gave rise to the symptoms of rather severe diabetes. Both the biliary and diabetic symptoms completely disappeared with subsidence of the infection.

The patient received 5.5 gm. tetrabromphenolphthalein intravenously. There was a severe reaction consisting of an intense headache, chill, palpitation, vomiting and prostration. The cholecystographic examination disclosed no gall-bladder shadow. An interesting finding in this case was the fact that duodenal injection of magnesium sulphate resulted in the production of the three typical specimens of bile including the dark (B) bile. The latter is believed by some to be bile ejected from the gall-bladder. Since there was no gall-bladder present in this case it follows that the B bile does not always come from the gall-bladder, if it ever does.

Mainoldi, Pietro. False traumatic pleurocele, *Arch. di radiol.*, Mar.–Apr., 1927, iii, 344–350.

The patient, a man of fifty-three, was injured in December, 1924; he was struck in the left half of the chest by the pole of a carriage which broke his ribs. When he recovered consciousness he had dyspnea and intense cyanosis, a feeling of oppression in the left half of the chest and pain which increased on coughing. A large painful swelling appeared in the region of the trauma which could be partially reduced. It gradually decreased in size. He had fever for a few days and bloody sputum from the fourth to seventh day. The author made a roentgen examination of the patient seventeen months after the trauma, in May, 1926. There was a protrusion in the left half of the thorax at the level of the third rib. It increased on expiration, was greatest on forced expiration with the glottis closed and disappeared on inspiration. A roentgenogram in the typical dorsoventral projection showed that it was filled with air and had a pedicle extending upward to where it communicated with the inside of the chest. When it was completely reduced and the air re-entered the chest a picture in lateral projection showed that it occupied a large triangular area in which there appeared to be septa. There were no signs of liquid effusion in the chest. Motility of the diaphragm was normal.

When a pulmonary hernia develops long after an accident and the lung covered with pleura projects through an intercostal space from atrophy of the soft parts it is a true hernia, but when the pleura is torn and the wall of the sac is formed by thickened fascia it is a false hernia. In this case the sac contained only air so it was a false pleurocele. The author thinks that the tumefaction observed immediately after the trauma was an emphysema, though the symptoms were not as serious as would be expected under those circumstances. The condition now presented by the patient is a sacculated pneumothorax, and on the assumption that the pneumothorax was brought about at the time of the trauma a pleuropulmonary fistula must also have been caused, as otherwise the air could not have remained in the sac for so long without being absorbed. So it must have been a valve pneumothorax. The lack of infection does not argue against this theory because other cases of valve pneumothorax have been observed which persisted for years without complications.

Mayer, Ernst G. The roentgen examination of the base of the skull for basal tumors. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 187–204.

For the examination of the base of the skull when a basal tumor is suspected there are five general roentgenographic positions capable of yielding satisfactory information. These may be variously combined according to the case under study. These positions are as follows: (1) a lateral exposure aimed at the sella turcica so as to give a general survey of the skull; (2) a sagittal general view in which the central beam runs along the axis of the intersection of the sagittal plane with the German horizontal plane; (3) a roentgenogram of the temporal bone by the Stenvers technique; (4) a submento-vertical roentgenogram of the middle cranial fossae; (5) an oblique exposure of the orbits by the Goalwin modification of the Rhese method.

Rarely are other typical or unusual exposures required to complete the diagnosis. At the base of the skull many pressure changes are easily demonstrable, and their appearance is such as usually to permit a definite conclusion regarding the position of the tumor. Local changes are found most frequently in the sella

turcica, next in the pyramids and in the body of the sphenoid, and in the large and small wings of the sphenoid. In the sella and pyramids, erosions are the only changes noticeable and their shapes are fairly characteristic for the various tumors. The wings of the sphenoid bone often show hyperostoses caused by the tumors.

Attention is directed to the possibility of error in interpretation caused, on the one hand, by the numerous normal variations occurring in the base of the skull and, on the other hand, by incorrect projection or by the confusing superposition of a number of complex skeletal structures. It follows that a knowledge of the possible variations in the normal skull outline must be possessed by anyone attempting the diagnosis roentgenographically. It is always advisable in studying roentgenograms and attempting to interpret the findings to visualize the exact direction in which the pictures were taken. A series of - illustrative cases are described, pictured and discussed.

MORRISON, L. B., and BOGAN, I. K. Bone development in diabetic children: A roentgen study. *Am. J. M. Sc.*, September, 1927, clxxiv, 313–319.

The study was made upon 68 diabetic children, all under fifteen years of age. The first observation noted was a delay of epiphyseal development and of shaft development in cases of diabetes of long duration. In direct contrast are the cases of recent onset in which the epiphyseal and shaft development appear to be in advance of the chronologic age. In other words, bone development is in advance of the chronologic age in children with diabetes of recent onset; and in children with diabetes of long standing the bone development is below the chronologic age. Narrowness of the shaft and thinness of the cortex characterize the diabetic children of long standing. Bone atrophy occurs in a certain number of children who develop diabetes before the ninth year but this has not been found before that age.

Transverse striae were found in 36 of the 68 cases. The incidence of the striae appears greater in these diabetic children than in the roentgenograms of children taken for fractures and other traumatic lesions. The slow growth of bone in the diabetic child may account for the high percentage of cases showing transverse striae since these lesions disappear more promptly in rapidly growing bones, according to observations reported from another laboratory.

OCKERBLAD, NELSE F. Stricture of the ureter in males. *J. Am. M. Ass.*, Feb. 19, 1927, lxxxviii, 544–548.

We are now convinced that ureteral kinks as demonstrated by the roentgen rays are mere signs of stricture of the ureter. Nephropexy is frequently done to cure kinks, but fewer nephropexies would be done if more ureteral investigations were made with large bulbs or catheters. While it is true that stricture of the ureter frequently causes changes in the kidney pelvis and ureter that are recognized as dilatations or distortions, one cannot say that because these changes cannot be shown in the roentgenogram no stricture is present. In 10 of the 31 cases observed by the author the roentgen-ray examination did not show the stricture which was located with the bulb. In 12 of the cases stone, either in the ureter or in the kidney pelvis was an accompaniment of the stricture. The association of stone and stricture is not one that should be ignored for it would seem that while a calculus may produce a stricture of the ureter, a stricture may possibly be responsible for a calcareous deposit. In 10 of the 31 cases the stricture was so small that a bulb would not pass and filiforms were resorted to; several of the latter were inserted into the ureter at one time and this advantage was followed up by a small Kelley with a stilet in it. In these cases the ureter would grip the catheter and proper dilatation has yielded highly successful results.

The localization of the stricture is made by the aid of the bulb and the ureterogram. The latter properly made is a distinct aid but is not infallible. Filiform strictures which hug the catheter or bougie are sometimes most difficult to locate with precision and the ureterogram often shows them to be several centimeters in length. The appendical area is one of the favorite sites for a stricture, which may thus be due to extrinsic causes. All the strictures in the 31 cases reported by the author were in the lower half of the ureter. It is not always easy to locate accurately ureteral strictures in men because the distance from the ureteral os to the external urinary meatus must be noted before the cystoscope sheath is withdrawn. Filiform strictures of the intramural portion and of the first 2 or 3 cm. beyond the bladder are fairly common and comprise about one-third of the present series of cases. In 13 cases the strictures were found to be bilateral, but many of the remaining 18 cases were not investigated to see whether they were bilateral.

PHILIPS, HERMAN B., and GALLAND, WALTER I. Longitudinal fracture of the neck of the radius. *J. Am. M. Ass.*, Apr. 23, 1927, lxxxviii, 1318–1319.

Report is made of an unusual and apparently

undescribed fracture observed in 5 children aged six to ten years. Identical roentgenological characteristics were seen in all the cases. The fracture can be seen only in the anteroposterior exposure and comprises a short longitudinal fracture line extending from the epiphyseal line at the neck of the radius close to its external margin distally to the cortex of the bone. The fracture is about $\frac{1}{2}$ inch in length. The small triangular external fragment may be displaced externally very slightly, but deformity was the exception and occurred in only one case. There were no roentgen-ray indications of fractures or displacements of the capital epiphysis of the radius or of dislocations or subluxations of the radiohumeral joint.

It is difficult to explain this fracture on anatomic grounds; it seems most likely to be an avulsion fracture. The stricture most probably concerned in the production of this fracture is a small part of the insertion of the supinator brevis, which is attached to the area of the radius to which this injury is confined.

REINBERG, S. A. Diagnosis of bronchiectasis by contrast roentgen examination. *Ann. de roentgenol. et radiol.*, 1927, ii, 151–172.

Bronchiectasis is by no means so rare as has generally been believed. Many more cases are found on the autopsy table than are discovered clinically. Clinically the cases are often treated as ordinary diseases of the lungs, most frequently tuberculosis. Even the sputum in 4 layers that has heretofore been considered as typical or even pathognomonic of bronchiectasis is found in other chronic purulent diseases of the lungs, such as certain forms of bronchitis, abscess and gangrene and interlobar pleurisies. An ordinary roentgen examination shows the majority of these cases of bronchiectasis that have not been diagnosed clinically. In the out-patient department of the State Institute of Roentgenology and Radiology at Leningrad during the past $2\frac{1}{2}$ years not less than 50 cases of bronchiectasis have been diagnosed and in most of them the diagnosis had not been suspected by the clinicians. But there are certain cases that cannot be diagnosed even by ordinary roentgen examination and in these contrast bronchography is necessary. The introduction of bismuth or lipiodol shows the existence of bronchiectatic cavities not shown by the usual roentgen examination. Ten illustrative cases are described and illustrated by roentgenograms.

REINBERG, S. A., and ARNSTAM, O. I. Metrosalpingographic roentgen studies of the anatomy and physiology of the uterine cavity and the fallopian tubes. *Fortschr. a.d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 54–64.

The procedure has definitely increased our knowledge regarding the anatomy and physiology of the uterus and the tubes. Serial roentgenograms were taken with lipiodol filled organs. The present report summarizes the findings made in 55 women of different ages, in some of the cases the genital organs being quite normal.

The normal uterine cavity assumes a symmetrical triangular shape in the living subject. The size of the cavity is somewhat larger in the living subject than it is in the cadaver. The shape of the normal cavity and its dimensions in the roentgenogram are to be ascribed to muscle tone and to the position of the uterus in the pelvis. The triangular shadow appears to be equilateral in those cases where the plane of the uterine cavity is parallel to the surface of the roentgen film. The various grades of deviation appear as more or less typical roentgen pictures and from the height of the triangle one may obtain an index as to the degree of version and flexion.

In the normal organ the distance between the two tubal ostia is 4 cm., the variation lying between 3.6 and 4.3 cm. As is well known to anatomists, the uterus in the great majority of cases is situated asymmetrically in the pelvis either to the right or the left of the median line, and the body of the uterus is at the same time very slightly turned on its longitudinal axis. Only in those cases where the organ is situated high in the pelvis at the promontorium is it found to be located symmetrically in the median line.

The shape of the vaginal cavity on the roentgenogram depends largely on the quantity of lipiodol injected and the position of the contrast material. The transverse diameter of the fornix vaginae *in situ* is rather wide and is found to be 5 to 6 cm. and in some normal cases as much as 7 to 8 cm. The volume of the uterine cavity varies normally between 3.5 and 4.5 c.c. A hypoplastic infantile uterus becomes filled with 2.0 to 2.5 c.c. of lipiodol and in pathological cases, especially fibromyomas, it may be as much as 6.0 to 8.0 c.c. Very much has been learned regarding the tonus of the uterine musculature by metrography. The triangular picture corresponds to the normal muscle tone and with decrease in the tone the shadow changes to a round or oval shape. This is very strikingly demonstrated in cases of atony or hypotony in the gravid uterus. Changes in tone are also observed as active characteristic movements of the uterus.

The contrast material is eliminated from the uterine cavity by a sudden general contraction of the entire muscle, all of the lipiodol being ejected into the vagina. Sometimes this ejection

takes place very shortly after the introduction of the lipiodol (within 35 to 40 sec.); usually this contraction does not occur for fifteen to twenty minutes. The patient remains entirely unaware of this muscular contraction even when expressly questioned upon the subject. The uterus also gets rid of the contrast material by a slow expression of the lipiodol through the fallopian tubes into the abdominal cavity. Serial roentgenograms show that the lipiodol is pushed through the tubes into the abdomen where it accumulates in perfectly characteristic droplets in the Douglas pouch. In cases of non-patency the tubes have been observed to dilate under the pressure. At no time were the authors able to distinguish definite peristaltic contractions in the walls of the uterus.

A hitherto unknown sphincter control at the uterine end of the fallopian tubes appears to have been demonstrated by these observations. It seems that under normal conditions the uterine cavity is separated from the lumen of the tube by the contraction of the sphincter. In some cases this sphincter absolutely cuts off the two cavities; in the majority of cases the closure is not complete and is definitely visible in the roentgenogram. The width of this sphincter appears to be between 1.0 and 1.5 mm.

These studies have also shown that the fallopian tube is very mobile and normally undergoes change in shape and position. Serial roentgenograms show distinctly active peristaltic movements of the walls and show a rapid transport of the tube contents. Evidence has also been obtained for the existence of a pro- and antiperistalsis in the fallopian tubes. Genuine properistalsis, that is in the direction of the uterus, was observed in only one case. It was found that the uterine contractions may occur jointly or may be entirely independent of the tubal peristalsis. In most of the cases observed these movements appeared to be independent.

Reiser, Egon. A gastro-jejuno-colonic fistula. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 243–247.

The patient was suffering from an ulcer in the pyloric region of the stomach. His condition was so poor that a resection could not be attempted. A gastroenterostomy was made in the lower third of the stomach, the pylorus being tied off by a fascial strip. Recovery from the operation was uneventful. Two years later the patient re-appeared with symptoms suggesting gastric ulcer, and a roentgen examination showed the stomach in an oblique position, of normal tone, and containing no residue. In the lower third of the greater curvature there was seen an anastomosis about 1 cm. wide which projected only about 1 cm. and opened into a diagonally crossing coil. After about a minute the diagonal coil began to show haustral markings. This indicated that the perforation was not into a dilatation in the peritoneal cavity but was into the transverse colon. The anastomosis itself was extraordinarily sensitive to pressure so that palpation had to be done with extreme care. The palpation gave an impression of firm infiltration at the anastomosis. A little more barium was ingested and this time the typical fine markings of the jejunum were seen. A portion of the jejunal coil could be followed aborally from the fistula upward in the direction of the left hypochondrium. The patient refused operation and further examination. However the diagnosis of the condition is quite definite.

Sante, L. R. Roentgen-ray diagnosis of pleural effusions, general and local. *J. Am. M. Ass.*, Jan. 22, 1927, lxxxviii, 215–218.

A brief discussion is given of the recognition, localization and differential diagnosis of pleural effusions. The roentgen-ray characteristics of these pleural effusions are briefly summarized as follows: In general effusions when the lung is well aerated and freely movable: (1) there is a dense shadow occupying the lower portion of the chest; (2) the costophrenic sinus is obliterated; (3) the upper border is curved, concave, extending upward and outward from the hilum toward the axillary line, showing little if any change on change of position of the patient; (4) there is displacement of the heart and mediastinal structures in large effusions; or when these structures are not displaced, a persistence of the aeration of the apex; (5) diaphragmatic shadows are obliterated and there is a continuation of the shadow of the effusion with that of the liver or spleen.

When the lung is consolidated or fibrosed and has lost its resilience, pleural effusion reveals itself in the roentgenogram by a ribbon-like shadow along the parietal wall of the chest. In local effusions there can be observed: (1) the entrapping of fluid usually during the course of the inflammatory process; (2) the effusion may occur in any location where two pleural surfaces come in contact with each other; between parietal and visceral pleural layers; at the anterior, posterior or lateral chest wall, between diaphragm and lung, mediastinum and medial border or between the lobes; (3) whatever the location, the effusion produces one characteristic shadow having a convex rounded border with its base at the periphery and the convexity inward toward the lung.

Sgalitzer, Max. Roentgen examination in the sick room. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 48–53.

Roentgen examination in the sick room has proven of great advantage in cases of fracture of the lower extremities because the procedure can be employed very readily and frequent roentgen examinations improve the prospects of a satisfactory end result. A roentgen examination in the sick room is also of great use in cases of acute illness involving the lungs or the gastrointestinal tract, in general, in all cases where the condition of the patient makes undesirable his removal to the roentgen department and where an examination in the horizontal position may be expected to be of value.

For roentgenoscopy in the undarkened sick room a cryptoscope should be used, preferably the so-called "fracture cryptoscope." With this device the roentgen tube is located above the fractured extremity and a reflecting mechanism deflects the rays to the observer's eyes. For purposes of lateral roentgenoscopy of fractured legs or for the study of the lungs or the gastrointestinal tract, the above fracture cryptoscope is transformed by two simple manipulations into an ordinary cryptoscope useful for ordinary roentgenoscopy.

In the pulmonary or gastrointestinal examination in the sick room the patient is turned over on a portable wooden table which is placed against the bed. Beneath the table is fixed a small tube holder furnished with a square diaphragm freely movable in every direction. During a roentgen-ray examination in the sick room special care must be taken that the persons assisting be carefully instructed and all outsiders should be prevented from coming in contact with the high tension current during operations.

Sievers, Roderich. Roentgenography of the joints with iodipin. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 16–28.

The author reports 6 cases in which 40 per cent iodipin solution was employed as a contrast material in the roentgenography of the joints, especially the hip. The iodipin is very useful for the purpose, for it is sharply contrasted even in thin layers, is non-toxic, does not injure the tissues and appears to inhibit development of adhesions. Recent experience with the method has been confined principally to application in cases of congenital dislocation of the hip. Owing to the retardation in ossification in the early cases, this method may solve difficult diagnoses by revealing the relation of the cartilaginous head to the acetabulum. A more definite prognosis may also be made with respect to reposition and retention, for it reveals many of the details of the joint interspace. The method also offers a means for determining the results of therapy.

Irregularities in the articular cartilage coating of the head of the femur are demonstrable with iodipin as is illustrated in the case of Perthes' osteochondritis. It appears probable that the iodipin injection has certain therapeutic advantages, mechanically in a cushioning effect of the oil, and chemically as a disinfecting agent. The extraordinarily slow resorption of the material may interfere with a subsequent observation of the finer structural changes in the skeleton and may thus constitute a disadvantage of the method.

The injection technique especially in the hip joint is not simple. Injection should be made only into the joint space, and outflow from the site of puncture into the periarticular soft tissues should be reduced as much as possible. The roentgenograms obtained should be interpreted with the greatest caution for the anteroposterior position of the whole amorphous iodipin shadow even in roentgenograms taken in both directions is very hard to make out in detail, and the periarticular accumulations due to backflow often obscures the picture. Stereoscopic roentgenograms should be more satisfactory.

Simonson, S. Giant calculus of the ureter. *Ann. de roentgenol. et radiol.*, 1926, ii, 123–126.

A patient thirty-eight years of age had had attacks of acute pain in the right side of the abdomen six years ago for which appendectomy was performed without any relief. The pain had become incessant and was now accompanied by rise in temperature. A roentgenogram of the pelvis showed an intense, sharply defined, sausage-shaped shadow beginning at the lower part of the right side of the sacrum and extending deep down into the pelvis. It was 9.5 cm. long and 3 cm. wide. A diagnosis of calculosis of the right ureter was made. Operation confirmed the diagnosis. A calculus 8 cm. long and 2 cm. wide was removed; it weighed 32 grams, was light brown in color and the shape of a slightly curved sausage. It was not examined chemically.

Steffens. Observation of heart movement from a shell fragment in the heart. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 84–85.

Roentgen examination of a war veteran showed, in the dorsoventral position, a fragment about the size of a cherry pit in the right

lower quadrant of the heart shadow on the right auricle. This fragment was seen in all diameters at least 1 cm. to the left of the right or posterior boundary of the heart and within the heart shadow. The fragment was found to move synchronously with the radial and carotid pulse toward the left downward with an excursion of about 2 to 3 cm., the path taken being slightly convex downward. At diastole it followed the same swing back to its original position. The excursions were especially distinct as a regular pendular movement when the respiration was suspended. Before the beginning of the movement to the left or at the end of the swing to the right (i.e., before systole or at the end of diastole) there was also observable a fine very slight upward quiver of the fragment. Simultaneous observation of the fragment and the heart apex shows that these approach each other at systole. These facts combined with observations of the movement in the left oblique position fix the location of the fragment in the right lower posterior portion of the anterior heart wall.

STEINHARTER, E. C., and BROWN, SAMUEL. Roentgen-ray examination of the uterus and fallopian tubes with iodized oil. *J. Am. M. Ass.*, March 19, 1927, lxxxviii, 917–918.

The authors began early in 1926 to test out the value of uterograms taken with iodized oil. The technique employed was as follows: The patient comes to the roentgen-ray department after having received an enema and a vaginal douche. She is placed in a recumbent position and the legs are put in stirrups. The external genitalia and vagina are cleansed with soap and water, followed by an application of 5 per cent trinitrophenol solution in alcohol. A speculum is inserted into the vagina and the cervix is grasped with forceps and swabbed with trinitrophenol solution. A cannula to which a piece of rubber tubing is attached and by which it is easily connected by means of an adapter to a 20 c.c. Luer syringe is passed through the cervical canal to a point just beyond the internal os, the air in the cannula having been previously displaced by the oil. With gentle pressure on the Luer piston, from 3 to 5 c.c. of oil is introduced into the uterus and then a roentgenogram is made. Following this about 10 c.c. more of oil is injected and another roentgenogram is taken. The cannula is then removed and the oil is allowed to flow out. The entire procedure is practically painless to the patient. Symptoms have not developed later in any of the cases observed by the authors. It has been found that to obtain information about the tubes it is necessary to inject about 10 c.c. of oil, although a lesser amount is more likely to bring out small irregularities of the uterine cavity.

This method does not displace the Rubin test for the investigation of the patency of the fallopian tubes. As an adjunct to the Rubin test it may be used to localize the point of obstruction in non-patency of the tubes and to determine whether or not one or both tubes are patent.

Roentgenograms obtained by this method assist one in diagnosing intrauterine conditions, mural fibroids, patency of the fallopian tubes, size and position of the uterus and early pregnancy and also permit one to differentiate intra-uterine from extra-uterine tumors. The injection of the iodized oil into the uterus and tubes is harmless.

STIEDA, ALEX., and SCHMIDT, FRITZ. Visualizing the gall-bladder in the roentgenogram by oral administration of contrast material. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 74–77.

Merck's tetrabromphenolphthalein in hardened gelatin capsules has been found valuable for diagnosis. From 10 to 14 capsules (5 to 7 gm.) are administered on the night preceding in a dish of rice and milk without any other preliminary preparation of the gastrointestinal tract, the patient not receiving any more food until the time of examination. Hypophysin injections have been found useful in stimulating the contraction of the gall-bladder. One c.c. is injected intragluteally before the meal and a similar quantity after the meal in order to empty the gall-bladder. The first roentgenogram is taken twelve hours after the ingestion of the capsule. Dorsoventral roentgenograms in the right oblique position are taken after 12, 16 and 20 hours. Six illustrative examples are cited. The authors have observed hardly any after-effects and regard this method suitable for ambulant cases. It is pointed out that a diagnosis of gall-bladder disease based solely upon the roentgenogram is not permissible.

TALIA, FERDINANDO. Gummatous gastritis. *Arch. di radiol.*, Mar.–Apr., 1927, iii, 424–426.

Two cases of syphilitic gastritis are described, one in a man aged forty-two, and one in a man aged forty and the roentgenogram of one of them is reproduced. The other is not reproduced because the gastritis and the characteristic roentgen findings disappeared under antisyphilitic treatment. Gummatous gastritis is quite rare and if not generalized occupies the pyloric or cardiac part of the stomach, less frequently the middle part. The roentgen picture shows the

lacunar image characteristic of gumma and when it is ulcerated niches and pockets. The lesions are generally multiple. When the gumma is located at the pylorus the clinical picture is that of organic stenosis with compensatory dilatation of the esophagus. If the site is at the cardia the pylorus remains permeable for a long time but contrast medium remains for a long time in the interstices in the gummata. Anacidity or hypoacidity are important clinical symptoms; they may also be indications of gastric ulcer or carcinoma but the differentiation can be made by means of antisyphilitic treatment.

Trerotoli, Paolo. Diagnosing the age of fractures by roentgen examination. *Arch. di radiol.*, Mar.–Apr., 1927, iii, 369–408.

From a roentgen study of 44 cases of fracture of the epiphysis without displacement, 12 cases of fracture of the epiphysis with displacement, 15 cases of fracture of the diaphysis without displacement and 16 with displacement and 32 cases of fracture of the phalanges, metacarpals and metatarsals, brief histories and roentgenograms of which are given, the author concludes that in simple fractures of the epiphysis without displacement there are no changes in the first three or four days after the lesion. After that there is a slight blunting of the edges which becomes more and more marked. In the first week a slight opacity of the fracture line begins. The formation of a cloudy mass begins about the tenth day and increases during the first month. After that the opacity of the callus, which began as a cloudy mass, becomes denser and more uniform until the third month; at that time the fracture line sometimes disappears. Ossification of the callus begins to be evident in the fourth month; the callus gradually decreases in size and begins to show the normal structure of bone. In fractures of the epiphysis with displacement of the fragments the blunting of the margins is delayed as compared with that in simple fracture. After two weeks the margins are somewhat rounded and the beginning callus can be seen in the second month. From this time on the callus is shown by an opacity which increases more or less slowly and becomes very large in the fourth to sixth month, and then decreases but never disappears entirely, and calcification begins within rather wide limits of time. If the displacement is not too great the picture of bone callus appears within the first year; in cases with great displacement later than that.

In simple fractures of the diaphysis without displacement of the fragments the blunting of the margins takes place about the second week, but sometimes sooner. In the second half of the first month the callus begins and becomes abundant and homogeneous in the fourth month until it finally assumes the opacity and structure of bone. After two years the callus is small and very opaque. In fracture of the diaphysis with displacement the blunting of the margins and angles can be clearly seen in the second week, and may even be seen in the first few days after the fracture in the form of indistinctness of the margins. The callus begins in the form of a whitish cloud toward the end of the first month and slowly becomes better defined. A structure approximating normal appears about the end of the first year. If there is great displacement or other causes which retard the formation of the callus the roentgenogram shows approximately the nature of the lesion because while the callus is undergoing absorption its opacity increases. In fractures of the epiphyses of the phalanges the first change occurs about the end of the first or the beginning of the second week. At this time the callus begins, and it becomes distinct in the third and fourth month, from which time on it gradually assumes the opacity of normal bone. The same may be said of fractures of the diaphyses of the phalanges. The findings are almost the same in the epiphyses and diaphyses of the metacarpals and metatarsals; the only difference is the greater rapidity with which the changes appear.

In the long bones about four years after the fracture a dense line appears in the roentgenogram which corresponds to the initial fracture line and represents the final scar in the injured bone tissue.

Vajano, Domenico. Ascariasis of the digestive tract. *Arch. di radiol.*, Mar.–Apr., 1927, iii, 409–417.

A woman aged forty-seven had had gastric disturbance for about nine months, consisting of a feeling of dragging weight and swelling in the epigastrium sometimes amounting to real pain. She had eructation of acid and gas and sometimes attacks of vomiting four to five hours after meals. Her stools were irregular and she was generally constipated; no melena. Since an operation for myoma of the uterus two months before the gastric symptoms had increased and were accompanied by headache, irritability, nervousness, anorexia and emaciation. Roentgen examination showed a high, hook-shaped stomach with a begining period of active peristalsis followed by a long period of inertia. Emptying was slow even in the beginning and complete emptying required

about nine hours. The bulb of the duodenum was always injected and moderately painful on pressure. Roentgenograms ten and twenty minutes after the barium meal showed the base of the bulb regular, while its summit was lacunar; it showed stripes and polygonal transparent spaces due to twisted rows of ascarids. The beginning of the second portion of the duodenum presented the same appearance. The ascending branch of the duodenum showed the typical appearance of ascarids, delicate transparent stripes, some of them straight, some of them slightly tortuous, of varying length averaging about 2 mm. Roentgenograms taken with the patient lying down about an hour after the meal showed the bulb deformed. Along the greater curvature of the stomach there were some slightly irregular transparent stripes. Eight hours after the meal the stomach presented an irregular outline which suggested scirrhous cancer. But palpation showed that the deformity was spastic. Examination of the rest of the digestive tract showed only spastic irritation of the cecum, ascending colon and the beginning of the transverse. The question was whether the ascarids alone were causing the rather serious symptoms and roentgen signs or whether there was some other concomitant lesion. Anthelmintic treatment relieved the patient of all symptoms, showing that it was only the ascarids. The case shows how easily the symptoms of ascariasis may be confused with those of other more serious conditions if careful roentgen examination is not made.

VON BERGMANN, G., and BERG, H. H. The roentgen picture of the gastric mucosa. *Acta radiol.*, 1926, vi, 173–182.

The clinical importance of bringing out the details of the gastric mucosa is discussed by Dr. von Bergmann and the features of the mucosal relief in cases of gastric disease are discussed by Dr. Berg. Under the stimulus of Forssell's studies the relief of the mucous membrane brought out by the use of small amounts of viscous contrast medium in conjunction with a certain degree of compression has been studied for pathological changes in sufferers from gastric complaints. Apart from the radial folds extending from cicatrizing gastric lesions which is also demonstrable in duodenal ulcer and in jejunal ulcer there were also observed certain changes in relief which are apparently related to gastric processes. Hyperacidity appeared to prevail in conjunction with large folds and swellings visible in cases of ulcer or after operation for ulcer; on the other hand, in the case of wart-like or papillary granulations of the gastric relief, anacidity or subacidity was encountered. Round, coin-shaped defects in filling which again disappeared corresponded possibly to pseudo-polypi such as those described by Schindler; while apparently intragastric metastases of a melanosarcoma caused rounded filling defects the size of which seemed to increase rapidly. The roentgenological study of the relief of the gastric mucous membrane obviates the hazards of gastroscopy, and not only possesses practical value for the recognition of gastric and neoplastic changes, but also appears to offer great prospects with regard to the diagnosis of gastritis provided the macroscopic morphology and the functional contractility of the mucous membrane can be properly interpreted.

WAGGONER, R. W. Encephalography. *Am. J. M. Sc.*, October, 1927, clxxiv, 459–466.

A brief review is presented of the literature on encephalography and also an analysis of encephalographic studies on 10 patients, these cases being briefly reported.

In a small group of selected cases encephalography is a valuable aid in the diagnosis of intracerebral disease conditions; for instance, in the differentiation of the types of hydrocephalus, in determining the presence or absence of organic lesions of the brain following trauma, and in the localization of the lesion in selected cases of brain tumor. If properly done, the procedure is without serious and in most cases without severe after effects. The danger of its use has been over-emphasized in the past. Its value justifies its more general use but it is perhaps not without danger and should not be used indiscriminately. In one spinal cord case in which both tests were used the results by encephalography agreed with those obtained by a Queckenstedt test.

WHITAKER, LESTER R. Diagnosis of gallbladder disease. *J. Am. M. Ass.*, June 4, 1927, lxxxviii, 1791–1796.

The musculature is the agent that produces emptying of the gall-bladder and even in the presence of stones it may be actively functioning. Consequently, reflex symptoms of epigastric distress, gaseous eructations, nausea or vomiting may presumably result from contraction of the viscus on a mass of stones or débris following meals rich in fat; and in all probability typical gallstone attacks are produced by the active expulsion of stones into the bile ducts.

The important diagnostic criteria for cholecystography are: *For the normal gall-bladder*, (*a*) filling with opaque dye and shadow formation indicate activity of the mucous membrane

and a functioning musculature which periodically empties the viscus and allows refilling; (*b*) gradual reduction and disappearance of the shadow within two or three hours after a fat meal, indicating an active musculature and the absence of débris. *For the abnormal gall-bladder*, (*a*) failure to fill and failure of shadow production, indicating blockage of the cystic duct, destruction of the mucosa, the occupation of the viscus with foreign material, or lack of normal emptying of the gall-bladder from damage to its musculature; (*b*) mottling of the shadow in the area not overlapped by the duodenum or colon, indicating stones. Six cases are described as illustrations of the application of the physiological principles involved.

ROENTGEN AND RADIUM THERAPY

Anschutz, W., and Hellmann, Johanna. Corrected statistics of the Kiel Surgical Clinic on postoperative irradiation of mammary carcinoma. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 94.

Between 1908 and 1922 there were 348 cases observed. Of these 331 have been followed through. One hundred and sixteen were not irradiated and 215 received roentgen treatment. Among those not irradiated there died after five to ten years of observation 7 cases (6 per cent). Amongst those irradiated 11 died (5 per cent). The statistics after the three and five year periods are given for other groups having different degrees of involvement and metastases. The authors believe that irradiation with small doses of $^1/_2$ to $^2/_3$ of the skin erythema dose (not 30 to 40 per cent) with ten to twelve such treatments given during a period of two years appears at present to be the most suitable treatment.

Bakke, Sigv. N. Roentgen ray treatment of polycythaemia rubra (Vaquez-Osler). *Acta radiol.*, 1926, vi, 128–134.

A report is given of a case in a woman aged forty-six. A small roentgen treatment was tried in 1923 but seemed to have been without effect. At first she had 7.5 million erythrocytes and 148 per cent hemoglobin. On termination of the treatment she had 7.96 million erythrocytes. On presenting herself for treatment again in December, 1925, she had 10.05 million erythrocytes, 18,800 leucocytes and 161 per cent hemoglobin.

From Dec. 1, 1925 to Feb. 20, 1926 she received thirty treatments of roentgen rays each of three-fourths skin erythema dose. After an interval of somewhat over five weeks the erythrocytes had decreased to 7 million and the hemoglobin to 120 per cent. Without further treatment the red cells decreased to 4.16 million and the hemoglobin to 91 per cent in the course of two months. Four months later she was examined again and showed a slight increase of erythrocytes up to 5.5 million and hemoglobin up to 110 per cent. However, inasmuch as menopause had set in there was a possibility that this increase was only temporary. It is intended to administer another careful roentgen treatment if this slight increase should prove to be not temporary.

Béclère, A. The radiosensitivity of neoplastic cells. *Acta radiol.*, 1926, vi, 141–146.

The different radiosensitiveness of various neoplasms depends chiefly on the radiosensitiveness characteristic of the type of cell from which they originate. As a general rule it is somewhat greater in the case of new-growths arising by chance after birth. On the other hand, neoplasms of embryonic origin, embryonic changes of nevus-like character seem to be an exception to this rule and possess a radiosensitiveness that differs very little from the normal tissues from which they arise.

The radiosensitiveness of different cells of the neoplasm at any moment depends chiefly on their vitality and undergoes wide successive variations depending on the stage of cell activity, mitosis, multiplication, quiescence, or latency. The ability which is characteristic of cells in a state of more or less sluggish life of accumulating the doses without weakening the biological action explains the success formerly obtained by the fractional method of roentgenization with intervals between the doses. This suggests the advisability of renewed study of this method of treatment.

The increasing resistance offered by a neoplasm to radiation is a fact capable of several interpretations. Immunization by the rays has not been demonstrated with certainty. The natural tendency of the neoplastic cells to acquire a greater malignancy is facilitated and strengthened by the selective action of radiation which kills only the most radiosensitive cells. This results in the apparent formation of a new kind of cell which is at once more malignant and more radio resistant.

Béclère, A. The dangers to be avoided in radiotherapy of tumors of the cranial cavity and vertebral canal. *Strahlentherapie*, 1926, xxiii, 503–518.

The physician should always bear in mind when irradiating tumors of the cranial cavity

and spinal canal the possible dangers which are evidenced by the appearance of the so-called "pre-reaction." This consists of vascular dilatation, hyperemia, and serous transudation resulting in edematous swelling. These symptoms may be accompanied by hemorrhages and accidents of mechanical nature. Radiation therapy should be conducted with great caution, especially at the beginning of treatment; and exceedingly great caution is advised in cases of compression of the spinal cord. At the beginning of treatment a trial irradiation should be given, the dose being milder the more severe the symptoms. Further treatment must not be rigidly schedulized, but should be made dependent upon the reactions obtained in the individual case.

In general, the preferred treatment should consist of medium doses given at fairly short intervals rather than very strong doses at longer intervals. There are two theoretical objections to the method of choice, both based on the character of the tumors, e.g., inclosure within a solid walled bone cavity. One of these is a possible stimulative effect of mild dosage upon further growth of the tumors; and the second that the neoplastic cells can become immune to mild doses. Both of these objections are still poorly supported, if at all, by observed facts. Roentgen therapy has come to be an excellent therapeutic measure for the treatment of tumors within the spinal canal and the cranium, and if applied cautiously in suitable doses, it should never be dangerous.

BELOT, J. Treatment of superficial epitheliomas of the skin by a combined method. *Acta radiol.*, 1926, vi, 147–154.

An experience extending over twenty-three years has convinced the author that in the majority of cases of cutaneous epithelioma limited to the skin the combination of scraping and radiotherapy constitutes an ideal treatment. Statistics covering more than 6,000 cases show a percentage of cures amounting to 85 per cent.

The procedure followed by the author is to remove with the greatest care as much of the neoplastic tissue as possible, especially the epithelial pearls which are so resistant to the action of roentgen rays. Following this, compression and adrenalin are employed to blanch the area and roentgen rays are applied. A Coolidge standard tube is used operated with 22 to 25 cm. spark gap. Occasionally an aluminum filter 0.1 to 0.3 mm. thick is interposed. The dose administered varies according to the case between 10 and 15 H. The dose is applied over the whole scraped surface and over a border 7 cm. wide surrounding the area.

BERVEN, ELIS. Radiological treatment of sarcomas of the tonsils. *Acta radiol.*, 1926, vi, 183–210.

The various ideas concerning the nature of lymphosarcomas as genuine tumors are reviewed briefly with special reference to the clinical signs and symptoms of sarcomas of the tonsils. The chief diagnostic features of tonsillar sarcomas are differentiated from disease caused by (*a*) benign inflammatory or ulcerative processes; (*b*) diphtheria; (*c*) actinomycosis; (*d*) tuberculosis; (*e*) syphilis (luetic ulcerations and tumors); (*f*) carcinoma, and (*g*) leucemic and pseudo-leucemic processes. Special stress is laid upon the extreme difficulty of making a correct differential diagnosis in a tumor where syphilis and malignancy are concurrent. The danger of procrastinating with antisyphilitic treatment in such a circumstance is pointed out together with the necessity for beginning radiological treatment early. The various views as to risk of operative interference in sarcoma of the tonsil and the influence upon the prognosis of operating in these cases are discussed. The serious result of operation which is not associated with prompt postoperative radiological treatment is demonstrated by the rapid growth of the sarcoma after tonsillectomy in a number of cases from the author's series. These had to be controlled by radiation treatment.

The difficulty of establishing the diagnosis of sarcoma even by microscopic examination is emphasized and in the author's experience with malignant tonsillar tumors a diagnosis of the absence of malignancy is not conclusive unless supported by all the clinical factors as well. It is insisted that the microscopic examination forms only a part of the clinical investigation. When positive it supports the diagnosis, but when doubtful or negative it does not rule out the presence of malignancy. Nevertheless in order to be able to judge the results statistically and scientifically a microscopic diagnosis is necessary. The author describes his technique for making a biopsy with the least possible risk of spread of the tumor.

In treatment of tonsillar sarcomas the author employs the following method combining radium and roentgen rays: The roentgen-ray treatment is administered to the neck over a field about 10 × 10 cm. corresponding to the location of the tonsils and the lymph nodes in the immediate neighborhood, at a skin target distance of 40 cm., with a filter of 4 mm. Al or 0.5 mm. Cu, the tube being operated at 180 kv. Nine treatments of $\frac{1}{6}$ skin erythema dose or 6 treatments of $\frac{1}{4}$ skin erythema dose are applied in the course of ten to fourteen days, the total dose being about 1.5 skin erythema doses. With the same technique a second and third series of

treatments totalling one skin erythema dose are given at intervals of two months. The radium treatment takes place between the first and second roentgen-ray series, about three weeks after the beginning of the treatment. The radium tubes are applied to the surface of the tumor, 500 to 1,500 mg-hr. radium element being employed according to the size and spread of the tumor. The filter used is equivalent to 1 to 2 mm. lead.

Of 32 cases of tonsillar tumors treated most of which were diagnosed microscopically as lymphosarcomas, 21 per cent have been free from symptoms for three to nine years and all are living; 34 per cent have been free from symptoms for one year or more, all living; 53 per cent were free from symptoms 6 months to nine years, 4 patients died. Fifteen of the cases have had only a brief relief or no improvement from the treatment.

Bolaffio, M. Uninjured fetal development on conception during latent period following castration irradiation. *Strahlentherapie*, 1926, xxiii, 288–296.

A clear cut case is described occurring in a woman aged twenty-eight. The patient suffered from typical post-encephalitic paralysis agitans and on recommendation of nerve specialists it was decided to prevent further pregnancies. A roentgen castration was performed with a Symmetrie apparatus, Müller electron tube, 40 cm. gap (170 kv. at the tube), 3 ma., filtration through 0.7 mm. Zn. A Chaoul ray collector was used, the exposures being given anteriorly and posteriorly over fields 20 × 15 cm., focal skin distance 30 cm. Under these conditions a Wintz skin erythema dose was delivered in 33 minutes and the dose applied to the patient was two-thirds of the skin erythema per field. It was calculated that the ovaries in this case received 37 to 40 per cent of the skin erythema dose, i.e., a full castration dose according to Seitz-Wintz. The patient resumed coitus on the 18th day after treatment and five days later a normal period set in. After this there was complete amenorrhea. Signs of pregnancy appeared but since the patient's condition appeared satisfactory she was allowed to come to term and gave birth to a perfectly normal child. Following parturition another menstruation occurred although the patient did not suckle the infant. Since then menstruations have been absent. Apparently a freshly irradiated follicle had burst, the irradiated ovum was fertilized and by virtue of an apparently undisturbed development it must be concluded that it had remained undamaged.

Borak, J. The present status of roentgen therapy of Basedow's disease. *Strahlentherapie*, 1926, xxiii, 519–527.

Basedow's disease was the first of the internal diseases treated by roentgen rays (Williams, 1902). The problem of roentgen therapy in this disease is to relieve the patients as quickly as possible from the most threatening and disabling symptoms. On the average, about 20 per cent of all cases can be relieved to this extent in from one to four months, and about one-third of these will remain entirely free from further symptoms. Improvement appears to take place more rapidly the more acute the course of the disease. The thyreotoxic symptoms are usually relieved more rapidly than the decrease in size of the struma. This is regarded as evidence that the rays first affect the secretory function and only later exert an influence on the proliferative power of the gland tissue.

In no case is roentgen therapy contraindicated. It has no initial mortality, which is an advantage over the surgical method of treatment. The latter is indicated only after failure of roentgen therapy (including other conservative measures) and in cases in which mechanical factors necessitate immediate surgical relief. Roentgen therapy cannot replace operative therapy in Basedow's disease, but it can reduce to a considerable extent the number of cases requiring operation. The present method of treatment in the Holzknecht clinic is as follows: In an early case of Basedow's disease the whole thyroid gland including the thymus region is irradiated with a dose of 2 to 4 H ($\frac{1}{6}$ to $\frac{1}{3}$ skin unit dose) through 4 mm. Al, depending on the severity of the case. This dose is repeated twice in four to eight day intervals, after which there is a pause of three to four weeks. Acute cases are usually considerably improved after such a series. In chronic cases one such series of treatments rarely causes considerable improvement; but a second or third series brings a decided betterment. At the second and third sitting in each series the thyroid is irradiated frontally and not sagittally. The object is to expose the whole gland through a different field and to avoid injury to the skin. Not more than four series of treatments are given and if after four months from the beginning of radiation therapy there is no considerable improvement the case is referred for operation provided there is no contraindication.

Gassoul, R. I. Treatment of bronchial asthma by diathermy of the spleen. *Ann. de roentgenol. et radiol.*, 1927, ii, 226–235.

This method of treatment was first used by the author in November, 1924, in a case of severe asthma in which the usual remedies had not done the least good. It was more successful than he had dared hope. The patient had a severe attack after the fourth treatment but after the fifth treatment his condition began to improve, the attacks were further apart and milder. After 15 treatments the attacks stopped entirely, the patient gained weight and was able to go back to work.

The diathermia was applied with a Neo-thermo-flux apparatus with a current of 120 volts. The electrodes, measuring 7 × 8 cm. or 8 × 9 cm. were applied, one in front over the spleen and the other on the back at the level of the 9th, 10th and 11th ribs; 10 to 30 treatments were given two to three times a week with 0.8–2 amperes. The patients were followed closely and the treatment individualized carefully. In order to avoid suggestion a false diathermia was given first.

Brief notes are given of 13 patients, 4 men and 9 women from thirteen to forty-three years of age. General conclusions cannot be drawn as the number of cases is too small. The results were equally good in these cases. The method of diathermia of the spleen is harmless and sufficiently effective to be recommended, particularly in cases in which other methods, including roentgen therapy, have failed. The author intends to make a further study of the effect of diathermia on other endocrine organs, including the thyroid, suprarenals, hypophysis and sex glands.

GILBERT, RENE. A method of roentgen therapy of uterine fibromyoma and hemorrhagic metropathies. *J. de radiol. et d'électrol.*, May, 1927, xi, 282–285.

In an effort to find a golden mean between the methods of prolonged irradiation with small doses and a single large dose the author has adopted the following method: He irradiates through 4 fields, one ventral and one dorsal on each side of the midline, converging on the ovarian and uterine regions. The size of each field is 100 to 150 square centimeters or more in the case of very large tumors. The focal distance as a rule is 30 cm.; it may be 35 or even 40 cm. in large tumors. To bring on amenorrhea and reduce the size of the tumor 8 treatments are given in a period of 10–12 days. In this way each field is irradiated twice, being given an average skin dose of 650 to 700 R each time or a total of 1300 to 1400 R for each field. Each treatment lasts fourteen or fifteen minutes making a total of two hours of irradiation in ten to twelve days. The apparatus used is the inductor Neo-symmetry or in some cases the constant tension. In the case of the inductor apparatus the author uses 2.2 ma. The filter is $\frac{3}{10}$ mm. zinc and 1 mm. aluminum. The deep dose is 32 per cent at 10 cm. distance.

He has treated 41 cases in this way. He excludes one in which later histological examination showed carcinoma and in which this treatment should not have been given, leaving 40 cases with only one failure. Seven of the patients were between thirty and forty, 23 between forty and fifty and 11 between fifty and sixty. The menses did not reappear at all in 4 cases, they reappeared once in 29 cases, twice in 4 cases, three times in 1 case and four times in 1 case. Reduction of the size of the tumor generally began in one to three weeks.

GUTHMANN, HEINRICH, and BOTT, OSKAR. Temporary roentgen menolipsis (temporary roentgen castration). *Strahlentherapie*, 1926, xxiii, 488–502.

The experience of the authors confirms the opinion that temporary roentgen amenorrhea is an excellent therapeutic measure in a great number of gynecological conditions. Although the field of application appears to be very broad, it should be kept in mind that the radiation treatment should be employed only after other customary methods for the particular condition have failed. This policy is necessitated because of the side reactions incident to roentgen treatment. There seems to be no positive proof that a fetus will be injured by roentgenization of the mother. The indication for inducing a roentgen amenorrhea is more definite in those cases in which a possibility of childbearing is reduced. The authors, however, have not refused to induce temporary roentgen amenorrhea in fertile women when the proper indications were present. Some of the results obtained in the University Frauenklinik of Frankfurt are summarized.

HEINISMANN, J. I., and CZERNY, L. I. Roentgen treatment of syringomyelia. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 273–276.

In spite of the small number of cases observed, and the brief period of observation, the authors believe that the roentgen treatment of syringomyelia deserves consideration. The results in general have been significant and many times very striking, and where complete cure is not attained the treatment at least retards the development of this progressive disease. It is believed that further observation

of the patients and further use of the roentgen treatment will bring still better results.

The technique of irradiation employed by the authors is as follows: The diseased area, according to the localization of the pathologic process, receives three-fourths of a skin erythema dose for a period of three days (over the cervical, thoracic and lumbar segments). The tube is set at an angle of 45°. The radiations were produced by a Sanitas hard ray machine operated at 180 kv., spark gap 45 cm., 2.5 ma., Coolidge tube. The pause between individual series of treatments is one to one and a half months.

The cases treated included 2 women and 11 men between the ages twenty and fifty-six years. In 10 of the cases the process was localized in the cervico-thoracic region and in 3 it was localized in the lumbar region of the spine. Sensory disturbances were present in all cases. The results of the treatment showed subjective improvement of the general condition and disappearance of pain and paresthesia. There was also decrease of paresis, and in one case restoration of a tendon reflex.

HERRIMAN, FRANK RICHARD. Malignancy of the larynx and esophagus treated by radium emanation. *Laryngoscope*, 1927, xxxvii, 664.

When radium was first applied to malignancy of the larynx and esophagus, the methods were so crude and the results in practically all cases so unsatisfactory, that it was very soon abandoned. Malignant lesions in these structures are so inaccessible and the tissues of which they are composed so quickly rendered radiosensitive that radium has now few advocates as a treatment for disease there located. In the author's clinic the use of radium had been discontinued for several years when he revived the therapy, using a new technique, however—the implantation of radium emanation in screened "seeds," directly into the affected tissues.

For laryngeal growths the technique consisted in exposure of the malignant area by direct laryngoscopy or the suspension method—the latter being preferable. For growths situated in the esophagus, a standard esophagoscope was brought into service. When adequate exposure had been obtained, the dimensions of the growth were carefully estimated, and the entire area of malignancy implanted at regularly spaced intervals with the removable platinum radon seeds designed by Joseph Muir of New York. The employment of suspension laryngoscopy makes the placing of radium in the larynx a comparatively simple matter, and with the esophagoscope and the aid of the roentgenoscopic screen, it can be put in the esophagus with equal facility. The opponents of radium in the treatment of such malignancies have continued to cite the severe reactions and distressing sequelae which follow the use of the crude applicators first employed for work in these peculiarly sensitive structures. When the implantation technique was first instituted in the larynx bare tubes were employed, and the necrosis produced by these unscreened containers caused sloughing of the irradiated tissues, and frequently, grave injury to the adjacent healthy cartilage. In the esophagus the caustic rays were even more dangerous, for sloughing meant lung perforation with almost certainly fatal results.

The design of the seeds used by the author obviated practically all the difficulties encountered under the old methods. Implantation is by far the most accurate way of assuring even and adequate radiation throughout the neoplasm, and as soon as it became possible to implant a *screened* container, doing away with all danger of necrosis, the radioactive centers could be so placed that every section of the growth would be reached by the therapeutic rays, while all caustic action was eliminated. One of the most important features of these seeds is that they are removable, as this does away with the difficulties involved in permitting foreign bodies to remain in the tissues of the upper alimentary canal.

Details of 8 cases selected from a larger series are given. All the patients were "hopeless" so far as surgery was concerned, at the time the implantations were undertaken. When this report was made at the New York Academy of Medicine, December 22, 1926, the patients were all alive, although the period which had elapsed since the treatment was begun was insufficient to permit the drawing of any conclusions as to the permanent relief which could be afforded.

The author feels that even if no more than temporary palliation has been secured, this, in itself, is well worth the effort required to apply the treatment, inasmuch as every patient had been doomed to die within a few weeks, when they first came under his care. Most of them had been able to return to their regular occupations, and even those who were still obliged to wear tracheotomy tubes were comfortable and pursuing their ordinary mode of life.

HESSBERG, R. The treatment of retinal hemorrhages with roentgen rays. *Strahlentherapie*, 1926, xxiii, 313–317.

Although the roentgen therapy of the eye remains an incompletely explored field, one may utilize experience gained upon other

organs and employ filtered rays carefully dosed so as to produce so slight a degree of injury as to be negligible. The peculiar effect of the rays on the vascular walls suggested the employment of these rays in the treatment of refractory retinal hemorrhages such as those caused by arteriosclerosis, trauma and infectious diseases.

The method of roentgenization employed by the author was that proposed by H. Meyer, the rays being filtered through 4 mm. Al. In all cases a total of 2 to $2\frac{1}{2}$ complete doses were divided over intervals of eight days, each treatment consisting of half a dose. In one case, the rays were filtered through 0.5 mm. Cu. Thus far 5 cases have been treated, and these are briefly cited. The first was a case of juvenile retinal hemorrhage due to tuberculosis. The treatment resulted in a resorption of the hemorrhages in the irradiated eye, the control eye remaining unchanged and still showing blood residues. The second case was one of arteriosclerotic retinal hemorrhages which, after irradiation, were completely resorbed. Vision through the irradiated eye was better than that through the untreated eye. The third case was one of traumatic retinal hemorrhage which disappeared entirely without any other treatment besides roentgen irradiation. The fourth case was one of arteriosclerotic hemorrhage which quickly disappeared without any other treatment. The fifth case was one of syphilitic retinal hemorrhage, which also disappeared relatively quickly. The patient is still under treatment and has had no recurrence.

LA PLACA, GAETANO. Histolysis of skin cancers under the action of radium. *Arch. di radiol.*, Mar.–April., 1927, iii, 320–343.

The reason malignant tumors can be cured by irradiation is that the tumor cells are more sensitive to the rays than the cells of the normal tissue. The author studied two cases of epithelioma, one of the lower lip and one of the cheek, that had been treated with radium in order to determine if possible the mechanism by which the tumor cells are destroyed. He found that there was first a latent phase, then one of hypertrophy of the tumor cells which preceded their necrosis and then a phase of hyperplasia of the stroma which brought about cicatrization. Histolysis of the tumor cells is brought about by the leucocytes which accumulate in the irradiated tumor as they do in an inflammation. They first collect in a sort of mantle around the tumor tissue and gradually penetrate it, bringing about histolysis of the tumor cells. They probably bring about this histolysis by means of the cholesterin contained in them which disintegrates the lecithin of the tumor cells.

MUIR, JOSEPH. Radium implantation in esophageal cancer. *Laryngoscope*, 1927, xxxvii, 660.

Cancer of the esophagus is generally regarded as the most hopelessly incurable of malignant lesions. None of the forms of treatment which have proved successful in combatting cancer elsewhere in the body have heretofore been possible of application to the esophagus. Radium has been even less beneficial than surgery. Three prime drawbacks to this use of radium have always existed: (1) the difficulty of placing it accurately; (2) the practical impossibility of maintaining it in position long enough to be effectual, and (3) the great danger of burning the tissues, which will induce sloughing and fistula into the mediastinum—invariably a fatal accident.

To obviate these difficulties the author has elaborated a technique of radium implantation through a specially designed esophagoscope which can be readily carried out by anyone experienced in the use of this type of instrument. The field of operation is illuminated and an implanter passed through the tube, so that each radon seed may be placed in full view, and the entire lesion accurately mapped out and evenly implanted. The radioactive center employed is a removable platinum radon seed, which offers the double advantage of being so screened that it will not induce necrosis, and the possibility of removal by means of an attached thread so that no foreign bodies are left in the tissue after the contained radium emanation has entirely decayed. The entire procedure is facilitated if done under the roentgenoscope, though this is not absolutely essential.

The results in the small series of cases so far treated by this method have been highly gratifying, and although no permanent results can be reported before the lapse of five years, the author feels that the method merits a wide trial, even if it proves to do no more than prolong lives which otherwise will be very shortly terminated.

PAZZI, ERMANNO. Roentgen therapy of diseases of the prostate. *Arch. di radiol.*, Mar.–Apr., 1927, iii, 458–466.

From a study of 13 cases irradiated by Coleschi and reported by Bonanome before the Urological Congress in 1924 and 42 which he himself irradiated, brief histories of which are given in this article, the author concludes that roentgen therapy is beyond doubt effective in

diseases of the prostate but not to the same degree in all. The effect is better in the first stage of disease of the prostate in which there is little or no stagnation of urine. Its action is due particularly to relief of congestion of the organ which is sometimes inflamed. It also acts on the mucous membrane of the prostate and also certainly on the tumor of the gland, especially in soft hypertrophies, adenomas and adenomyomas, the degree of its action depending on the radiosensitiveness of the individual. It certainly has a hemostatic action which begins very promptly. Even in the cases in which there was little or no reduction in the size of the prostate after the roentgenotherapy there was a decided improvement in the subjective symptoms of the patient, such as pain, tenesmus, pollakiuria, etc. Irradiation should always be tried in diseases of the prostate before operation, for even if it is not successful or only partially so, it does not contraindicate later operation.

ZIEGLER, JOSEPH. The roentgen treatment of Mikulicz's disease. *Strahlentherapie*, 1926, xxiii, 528–531.

The main symptom-complex in Mikulicz's disease is a symmetrical swelling of the lachrymal and salivary gland but these are only aspects of a general involvement of the lymphatic system. The pathology of the disease is still not completely understood. A report is given of a case occurring in a man aged fifty-six. The symptoms were typical of Mikulicz's disease and a histological examination of an extirpated cervical lymph gland revealed only non-specific lymphatic tissue. The patient received roentgen treatment over the face, neck, chest, abdomen, gums, eyes, spleen, each area receiving one-third of a skin erythema unit except the gums which received one-fourth unit. The rays were delivered from a Lilienfeld tube operated at 2.5 ma. and 150 kv., 23 cm. distance, 3 mm. Al filter. The direct application of one-third skin erythema unit over the eye is entirely harmless. The effect of the roentgen rays upon the disease foci is purely local and only the irradiated areas show a reaction. The fact that swellings appeared over other portions of the body shows that the rays did not inhibit their formation. In general, it seems that a combination of roentgen therapy with arsenic medication is indicated for Mikulicz's disease just as it is in leucemia. A note is appended stating that one year after treatment no recurrences had appeared over the irradiated areas. Some new tumors did appear in the umbilical region but these were irradiated with satisfactory result. The patient has since remained in good health.

MISCELLANEOUS

AURÉN, T. C. The energy radiated as *x*-rays from a Coolidge tube. *Acta radiol.*, 1926, vi, 105–121.

An apparatus for measuring the absolute intensity of roentgen rays was constructed and measurement was made of the absolute intensity of the continuous spectrum from Coolidge tubes. At constant voltage the intensity at first increases rather faster than proportional to the square of the voltage, but from about 69 kv. on the increase is in exact accordance with this relation. With undulating voltage, where not the maximum but the effective voltage is measured this law is valid at considerably lower voltages. The intensity (I) at higher voltage than the critical is found to obey the following equation

$$I = ci(aV^2 - b)$$

where c is a constant, dependent on the distance from the anticathode, i is the current through the tube, V the voltage and a and b constants dependent on the shape of the voltage curve used. The author gives the constants for calculating the energy radiated from the anticathode when using constant voltage or undulating voltage of approximately sinusoidal form.

The intensity of the radiation filtered through aluminum can be calculated with the aid of the formula

$$I = I_0 e^{-md^n}$$

where I_0 is the energy of the incident radiation, I the intensity of the radiation transmitted through an aluminum filter of the thickness d mm. and m and n are constants depending on the voltage and the shape of the voltage curve. If the composition of the continuous spectrum generated with an undulating current at a certain effective voltage is compared with the composition of the spectrum generated with constant tension at the same voltage and the same current through the tube, the latter is found to contain proportionally more radiation of the longer wave lengths.

BECCHINI, GASTONE. Experimental study of the stimulant dose by means of basal metabolism. *Arch. di radiol.*, Mar.–Apr., 1927, iii, 437–448.

Becchini irradiated the thyroids of 14 normal individuals with small doses of roentgen rays and also those of two diabetics and, then made repeated tests of basal metabolism with the purpose of determining whether the amount of irradiation given had a stimulating action on the thyroid. In 13 of the normal individuals

who were given less than a therapeutic dose there was no change in basal metabolism that could be attributed to an action of the rays on the thyroid; in the 14th and in the two diabetics there was an increase, but these individuals were given therapeutic doses and the author thinks the increase was therefore a result of injury rather than of stimulus of the thyroid gland. He thinks there is no such thing as a stimulant action of radiant energy and that the authors who have reported such an action have worked on growing organisms or pathological ones, which are more sensitive to rays than normal resting ones.

Bellucci, Bruno. Tubes for the practical utilization of cathode rays. *Arch. di radiol.*, Mar.–Apr., 1927, iii, 362–368.

The bundle of cathode rays is independent of the kind of metal used as cathode and the velocity of the rays is due to differences of potential at the poles of the tube. The volume of each electron is infinitely small, 1860 times as small as an atom of hydrogen. But the volume of the electron depends on its velocity and increases as the velocity approaches that of light. The beta rays of radium are made up of negative electrons similar to those of the cathode rays. Devising a means of getting these cathode rays out of the tube in which they are generated is equivalent to rendering available a radiation like the beta rays of radium, but superior in quantity and quality. There have been very serious technical difficulties in the way of exteriorizing these rays but Coolidge has recently succeeded in overcoming them and making a tube by means of which the cathode rays can be utilized practically. The details of the construction of the tube are described and illustrated. These tubes have been made only recently so that practical results from their use cannot yet be reported but enough has been done to show that they have wonderful physical and biological effects and that they will doubtless be of great practical use in the treatment of tumors.

Caspary, Hans. A new centering device for roentgen tubes. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, xxxv, 96–97.

In this device use is made of the light of the filament current used in the thermionic valve. The original should be consulted for details.

Cave, H. M., and Gray, J. A. The scattering and absorption of the gamma rays from radium. *Phys. Rev.*, 1926, xxii, 103.

Gamma rays filtered through 2 cm. of lead have a mass scattering coefficient equal to 0.102 Z/A, where Z is the atomic number and A the atomic weight of the material used. The distribution of the radiations scattered from paraffin wax has been determined. The results indicate that gamma rays filtered through 2 cm. of lead have an effective wave length in the neighborhood of 0.012 Å.

David, O. Studies on the effect of roentgen rays on the capillaries. *Strahlentherapie*, 1926, xxiii, 366–368.

The author briefly summarizes the work of himself and his collaborators on the tissue changes involved in the production of the roentgen erythema and the roentgen effects on the deeper tissues. The roentgen rays produce their first effect upon the contractile elements in the capillary wall (e.g., upon the rouget cells). The sensitiveness of these cells varies amongst individuals. Oftentimes there occurs only a disturbance in function of these cells without the appearance of any demonstrable anatomic changes. Numerous late injuries after roentgen irradiations are due to the fact that vascular function is destroyed and the altered cells have not overcome secondary injuries.

Since it was found that there are capillaries which appear above suspicion anatomically but which nevertheless give distinct signs of functional inferiority, it becomes necessary to find methods for detecting these capillaries in the living being. This will furnish a means for most readily avoiding late roentgen injuries which arise from excessive injury of inferior or damaged capillaries.

Glasser, Otto, and Meyer, W. H. Erythema doses in roentgen units. III. *Strahlentherapie*, 1926, xxiii, 361–365.

Beginning with hard rays the curve showing the relation of the erythema dose in R units to the ray quality falls to a minimum for a radiation mixture corresponding to 2 mm. Al, half-value layer. This curve rises again in the case of still softer rays. For radiations usually employed in radiation therapy, the ratio of the erythema dose in R units (measured with a chamber freely exposed in air) to the half-value layer in water of the radiation producing the erythema is a constant. For the apparatus employed by the authors at the New York Post-Graduate Medical School this constant has a value of 220 for the customary factors of operation. It is about 135 for the operating conditions reported from Germany.

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